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THE PAN-AMERICAN EXPOSITION.

THE STADIUM.

The completed Stadium for the Pan-American Exposition at Buffalo, next year, will offer to the lovers of sports the most spacious and splendid arena ever erected in America. The athletic carnival to be held during the great Exposition will be the most notable in the history of American sport. The co-operation of many of the best promoters of athletic games and contests has been secured. Visitors to the Pan-American Exposition may, therefore, expect to witness the meeting of the most famous athletes of the world, in competition for prizes worthy of their best feats of endurance, strength and skill.

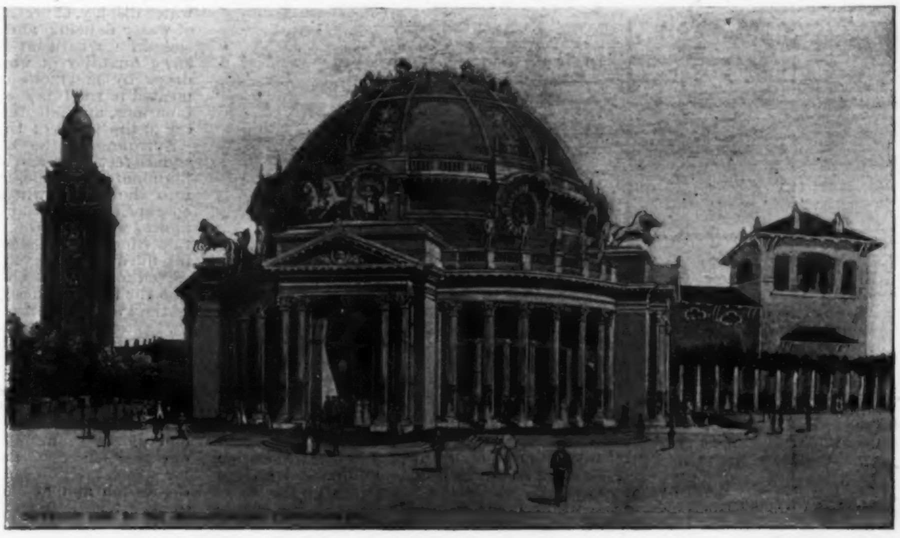
It is said that the great Colosseum at Rome, built in the first century of the Christian Era, could accommodate 87,000 spectators. The Pan-American Stadium will be 129 feet longer and but 10 feet narrower than the historic amphitheater of Rome. The Stadium, however, will have a larger arena, and the seating capacity is estimated for 25,000 people. The top row of seats will be 60 feet above the ground, and every seat will command a perfect view of the vast interior. Standards are to be placed at various points for the support of awnings in such a way that they will not obstruct the view from the other seats.

The Stadium will have a quarter-mile track and a sufficiently large space inside of this for any of the athletic games. Great attention has been paid to having a large number of aisles to reach the seats, and, in addition to the principal entrance on the west, there are provided seven large exists. These exists are made of sufficient breadth and height to admit, in case of need, the largest vehicles or floats, as it is proposed to use the Stadium for certain pageants, exhibits of automobiles in operation, judging of live stock, horses, agricultural machinery, road machinery, etc. No exhibitor has ever had such a splendid arena in which such exhibits could be displayed. The space under the seats is to be used for exhibition purposes, and is, in itself, the equivalent of a very large building.

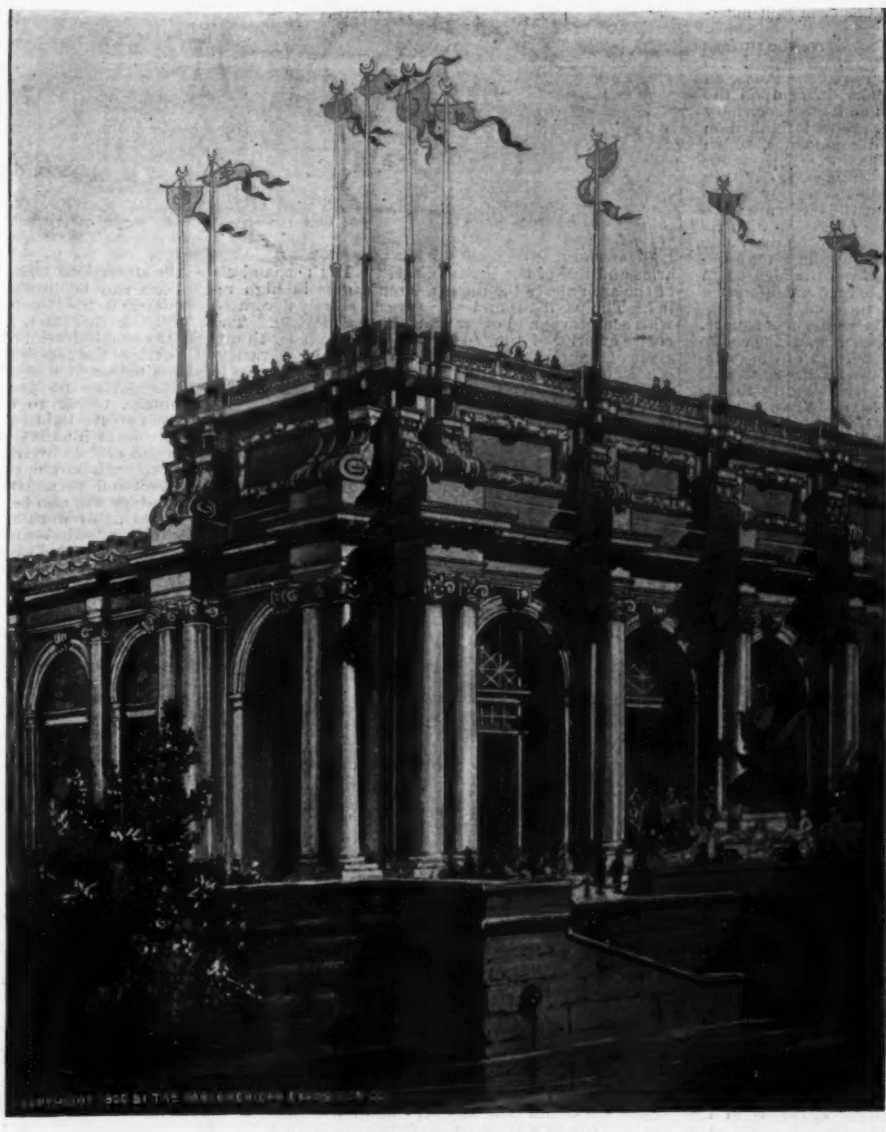
A large and picturesque building forms the main entrance to the Stadium. This is 241 feet long by 52 feet wide, with towers 164 feet high. The style is in conformity with that of the other buildings, with an arcaded effect in the lower story, red tiled roof, broad eaves and bright colors. The old Spanish towers give a finished beauty to the structure and make it one of the most prominent features of the Exposition.

The Stadium resembles in a general way that erected at Athens a few years ago, although this one can be, of course, only a temporary structure. It is intended as a model of what it is hoped may be executed some day in permanent form.

The Stadium will cover ten acres of ground and its situation is on the east side of the Plaza, opposite the Midway. It is near the great entrances from the steam and trolley railway station, at the extreme north end of the Exposition grounds.



ETHNOLOGY BUILDING.



A CORNER OF THE STADIUM.

THE GOVERNMENT BUILDING.

So vast is the number of valuable and interesting objects for exhibition in the possession of the United States government that none but a building of great proportions could possibly contain them. Instead of one building, however, at the Pan-American Exposition in Buffalo, N. Y., in 1901, the Federal group will consist of three massive structures connected by colonnades. The main building of this splendid architectural trinity will be 130 feet wide and 600 feet long. The others will each be 150 feet square.

The government work is under the direction of James Knox Taylor, supervising architect of the Treasury Department. The group will be treated architecturally in a modified Spanish Renaissance, the details suggesting a Mexican rather than a strictly Spanish origin. Like the others, these buildings will be constructed of staff, already made familiar to the public by its use at the Chicago and more recent Omaha Exposition. The color scheme, in marked contrast to that used at Chicago, will be rich and brilliant, the lavish use of color and gilding giving, with the intricate plastic decorations and sculpture groups, an ensemble both striking and interesting. Portions of the roofs, covered with red Spanish tiles, will add much to the character of the buildings as a whole.

In plan, the buildings are shaped like a letter U, the opening being toward the west. The main building corresponds to the bottom of the U, which will accommodate the greater portion of the Government exhibits, the administrative offices, guard room, etc. Its center will be surmounted by a dome, the apex of which, 250 feet above the main floor level and crowned with a figure of Victory twenty feet in height, will form one of the most conspicuous features of the Exposition grounds. Connected by colonnades to the main building are the two lesser buildings or pavilions, one of which is intended to hold an exhibition typical of life and labor in the Government's new possessions; while the other will contain a branch station of the United States Weather Bureau, and the exhibit, aquariums, etc., of the United States Fish Commission.

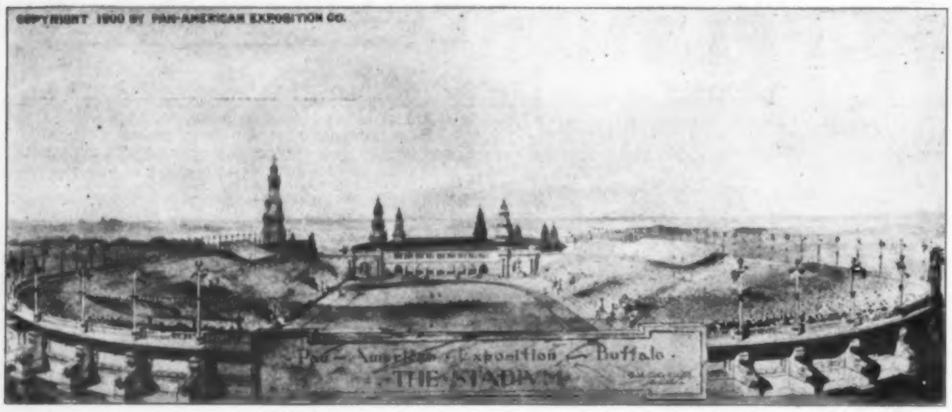
Inlets from the lagoon fill the spaces within the colonnades connecting the pavilions with the main building. The central plaza, the space enclosed by the arms of the U, is decorated by steps, terraces and formal flower beds, making an easy and beautiful approach to the main entrance under the dome.

THE SERVICE BUILDING.

The large Service Building, although small in comparison with the big Exposition structures, was completed in thirty-two working days, and was the first building erected on the grounds. It is the present home of a large corps of officers and employes having immediate charge of the constructive work of the Ex-

position. This handsome building is on the west side of the grounds, and is 95 by 145 feet, two stories high. A broad arched driveway on the north side leads to an inner court. To the right and left of the driveway are entrances to the corridors that open into the various rooms of the building.

In this building are the offices of the Director of Works, the Landscape Architect, Superintendent of Building Construction, Purchasing Agent, Chief Engineer, Mechanical and Electrical Engineer, with their numerous assistants. On the second floor is a large drafting room for the use of the architects, with fire-proof vaults at hand for the valuable drawings. In this building will also be the headquarters for the police and hospital service, the fire department and the officers in charge of the transportation and installation of exhibits, and other officers. The building is equipped with a cellar, kitchen, dining-room and numerous sleeping apartments, for the accommodation and comfort of those whose work requires their continuous presence on the grounds.



THE ELECTRIC TOWER.

The dignified and stately beauty of the great Electric Tower, which will form the conspicuous centerpiece of the Pan-American Exposition at Buffalo next year, will command the rapt admiration of every visitor. The genius of the architect has been taxed to preserve lines and elements of beauty in a work of such tall proportions, but the problem has been well mastered.

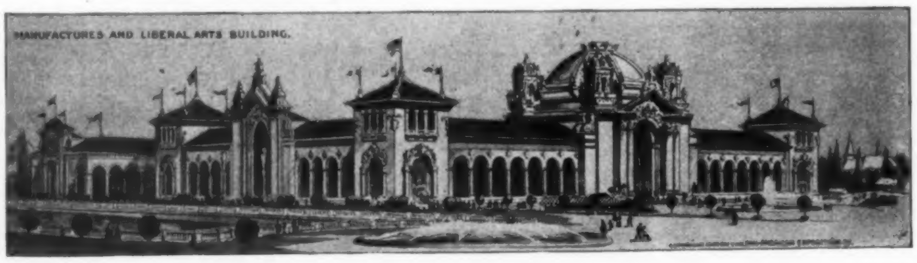
The height of the Tower is 348 feet above the surface of the broad basin in which it stands. Its position is between the Court of the Fountains and the Plaza, on the north side of the Mall. It looks down upon the Agricultural Building at the east and the Electricity Building on the west. The Tower proper is flanked on the east and west by long curved colonnades, which sweep to the southward and terminate in airy pavilions forming a semi-circular space 200 feet across. Within this space and in a high niche in the main body of the Tower are cascades, while all about the basin are leaping jets and countless playful figures, each with its spurt of water, combining to make a brilliant water scene. At the center of the niche is a tall geyser fountain whose waters find their way from the high basin within the niche over successive ledges and among a multitude of vases to the level of the pool.

The main body of the Tower is eighty feet square. From the surface of the water to the top of the colonnades is seventy-five feet. This portion of the structure is enriched by a system of decorative rusticated bands, which give an aspect of great solidity to the base. The shaft of the Tower is treated with great simplicity. The center of each side is paneled with fantastically perforated work, through which is indistinctly revealed the massive frame work of the Tower. This feature is calculated to produce a remarkable effect when lighted from within, as it is the intention to do. The main shaft of the Tower terminates in an elaborate entablature at the height of 200 feet. The crown of the Tower rests upon this entablature, and is composed of three stories of diminishing proportions and varying design. The lower of these stories is an arcaded loggia, rich in ornamentation and having the wall surfaces brilliantly colored. Pavilionettes at the corners terminate in light fantastic cupolas. The second stage, or lantern of the Tower crown, is in the form of a high, circular colonnade, entirely open, so as to allow the effect of the sky to be seen between the columns. A spiral staircase within the colonnade leads to the last stage of the Tower, the cupola, over whose soaring dome is posed the superb figure of Electricity herself, thus dominating the entire Exposition, which owes so much to her generously exerted power.

From the water to the feet of the figure of Electricity is a vertical distance of 331 feet. The figure is seventeen feet in height.

The entrance to the Tower is across an ornamented bridge from the Plaza, on the north side. Elevators will carry passengers to the various floors, which will be devoted to different purposes of the Exposition, such as reception rooms, offices, restaurants, belvederes and amusement halls. A large restaurant, at a height of 200 feet, will give the diner a broad and beautiful view of the Exposition and the surrounding landscape. From the cupola the eye can sweep the whole Niagara frontier, and look far into Canada, beyond the majestic river that separates that country from the States.

Sculpture plays an important part in the decoration of the Tower. Two magnificent monumental groups of statuary flank each of the four sides of the base. Above the water niche, in the southern face of the Tower, is a magnificent escutcheon, representing the arms and seal of the United States. In the spandrels of the arch above the niche are sculptures in high relief. The pavilions and wings are also richly decorated with sculptures and other architectural devices. The entire exterior of the Tower will be studded with myriads of electric lights, so arranged that a great variety of effects can be secured. The use of electric lights in combination with the sparkling fountains and cascades will produce scenes of fantastic beauty.



THE ELECTRIC ILLUMINATION OF THE PAN-AMERICAN EXPOSITION.

The Department of Works has submitted to the Director-General of the Pan-American Exposition a statement setting forth in detail the plans for the electrical illumination of the Exposition. These plans provide for electrical displays of surpassing brilliancy and beauty, and will bring a gratifying and memorable realization of the prediction heretofore frequently and confidently made, to the effect that the electrical features of the Exposition will be more attractive and more wonderful than any scheme of illumination ever carried out on a large scale. Briefly outlined, the plans prepared by Mr. Luther Stieringer, Consulting Engineer, and Mr. Henry Rustin, Chief of the Mechanical and Electrical Bureau, are as follows:

The Court of Fountains, flanked on either side by the main buildings and the Esplanade, with its sunken gardens of tropical foliage, is 1,700 feet long and has an area of 850,000 square feet. This Court will be brilliantly lighted without the aid of a single arc lamp. It will be done by the use of over 100,000 incandescent lamps of 8 and 16 candle power. An illumination highly diffused and with no intense points of brilliancy—in fact, light without shadows—will thus be obtained. Is it necessary to say more to indicate that the Court of Fountains at night will be fascinating beyond description?

The Electric Tower, situated at the north end of the Court of Fountains, and as seen from the bridges spanning the artificial lakes, will form the center of a beautiful vista. This tower, designed by Mr. John G. Howard of New York city, member of the Board of Architects, is 300 feet high. It has on either side harmonious colonnades, and in the immediate front and facing the Court of Fountains is a niche 70 feet high and 30 feet wide. In this niche will be an extensive water display, expressed in countless individual drops of water dancing and rollicking, and subjected to an elaborate treatment of electric coloring. Picture a large quantity of water thus broken into individual drops by ingenious devices, each drop a prism permeated to the fullest extent with color in limitless combinations, and fanciful figures formed in water appearing in the midst of the scene.

Surrounding the Electric Tower is a basin, 90,000 square feet in area. In front of the niche will be an illuminated cascade, the waters of which finally flow into the basin, where will be numerous allegorical conceptions of statuary rising from the water. These figures will be surrounded and embellished with fountain effects on a scale equal to the magnitude of the intended imposing fountain and water display conceived for the Exposition, and in some respects not unlike the fountain designed as one of the main features of the Paris Exposition.

Designs are being developed for electric fountains further to embellish the interior courts of the several buildings, and plans are in preparation for the illumination of the Grand Canal over its course of several miles, also for an effective electrical treatment of the caverns and grottoes, and other fanciful features.

The large lake, called the Gala Water, at the south end of the grounds, is particularly well adapted to effective electrical and water effects, detailed plans for which are now being made. As the lake lies in a depression and its banks gently slope to a height of some 50 feet, it is a natural amphitheater, and it will afford an excellent opportunity for spectators to view the attractions that will be provided. These attractions can be introduced here without any material change in the lake or park, as they will be mostly of a floating character, readily removable. The ideas are far enough developed to show that advantage will be taken of the possibilities of the Gala Water by the introduction of a great variety of electrical and other effects, that no preceding exposition has been able to obtain, owing to the interference of buildings and competitive lighting that have marred the very best scheme of illumination.

One of the novelties planned is an electrically luminous air fountain, capable of an iridescence and color effect and peculiarity of form never yet shown. Advantage will also be taken of the opportunity for electrical figure work in the water basin—an opportunity rarely afforded—and the display here will be exceptionally fine and extremely pleasing.

A general idea of the extent of the electrical requirements of the Exposition is indicated by the statement that illumination must be provided for more than 250 acres of buildings and grounds. There will be thousands of lights for decorating and special effects and thousands of horse power for fountains and driving machinery, and for telephone, telegraph, fire alarm and signal purposes, all forming a network of electrical service well-nigh equaling in extent and variety the electrical service of a large city.

Briefly put, the projected plans provide for a more magnificent illumination of the grounds of the Exposition than has ever been attained on so large an area. Beyond question the result will be an unparalleled electrical triumph—a brilliant celebration of electrical development and achievement at the end of the nineteenth century and the beginning of the twentieth.

ATMOSPHERIC ELECTRICITY AND DISEASE.

Last summer I had the honor of making the acquaintance of Dr. Schliep, of Baden-Baden. He is well known to English medical specialists. He urged me to design a recording electrometer, such as would enable medical men to study atmospheric electricity. I found that he himself had made daily observations for twenty years, using a gold-leaf electroscope, which enabled him to say whether the air had strong or weak, positive or negative, electric potential, at the end of a water-dropping collector. He showed me that he had made an earnest study of the connection between atmospheric electricity and diseases, and I am convinced that his conclusions are of great importance. I feel, therefore, that I am doing a service in bringing before the notice of readers of Nature the following account

of a paper, by Dr. Schliep, in Sonderabdruck aus Deutsche Medizinal-Zeitung.

He first refers to the meteorological observations usually made, and goes on to say that our knowledge of atmospheric electricity is now as vague as was the knowledge of warmth before thermometric observation became systematic. Dove, in 1847, and Humboldt, in his Cosmos, mentioned the importance of the study of atmospheric electricity. Dr. Graves, of Dublin, made observations and said: "Practically these experiments are of importance, because some causes of the periodicity of certain acute diseases, their decrease and increase at certain hours of the day, may be deduced from them." Hufeland also refers to this matter. Dr. Buzorine, of Würtemburg, in 1841, drew attention to the fact that during the cholera epidemics of the third decade of this century, there was a prevalence of negative electrification of the atmosphere. Dr. Pallas, a French physician, wrote on this subject in 1847, and Dr. Craig, an Englishman, wrote about it in 1859.

Dr. Schliep now describes his method of observation with the gold-leaf electroscope, and gives the following results. The first part of these may be said to be well known to us. What seems to me of most importance is the effect on organisms.

Atmospheric electricity is generally positive. If the sky is covered, the potential decreases or shows variations, and is from time to time negative. During rain, negative potential is often observed. The approach of a thunderstorm is generally marked by great alteration toward the negative, followed by considerable oscillations in both directions, with a predominance of negative. Usually the positive potential is higher and more regular during the night than during the daytime. From 9 P. M. to 3 A. M. the potential changes little. It diminishes by daybreak, reaches its lowest value at 3 P. M., then increases and reaches the maximum at 9 P. M. There is, therefore, a minimum during the day, and an almost constant maximum during the greater part of the night; that is to say, there is only one daily period. These facts are deduced from the use of the registering apparatus of Mascart. Other observers have found two maxima and two minima, but they are probably only accidental variations. In every month there are a number of days on which negative electrification can be observed, others, and they are rare, when there is scarcely any electrification noticeable. On most days there is positive potential.

According to Marié Davy's observations in Paris, and Dr. Schliep's at Baden, there are two days of positive electrification for 28 negative. The winter shows higher potential than the summer.

Many terrestrial phenomena, such as earthquakes, are said by trustworthy observers (Schubler, Humboldt) to greatly influence atmospheric electricity. After an auroral display there is strong positive electrification. At greater elevations, especially on steep and high mountains, the electrification is greater.

Dr. Schliep makes the following statements about the influence of atmospheric electricity on human beings: Negative electrification is tiring, positive is exciting. Positive is favorable to the process of oxidation, increases metabolism, circulation and secretion. It may be that the increased formation of ozone has an influence in this way also, but we can imagine a direct stimulating influence of positive electricity on the nervous system. We may affirm the existence of this influence as, during strong electrification, disturbances of the normal condition are noticeable, as in sleeplessness, the existence of states of anxiety, hysteria, neuralgia, and even sometimes inflammation of the respiratory organs. One interesting confirmation of this opinion is found in the observations which Eyselein has made regarding the behavior of nervous people, as influenced by the amount of ozone in the air. It seems that if there is too little ozone, and especially if it completely and suddenly disappears, there is considerable bodily disturbance; while its sudden reappearance causes a quick return of healthy feeling. It has also been proved that a continuance of much ozone is not unfavorable to health. Ozone intensity less than No. 10 of Zender's scale, but not much less, has a tonic effect on nervous people, but intensities from 9 to 4 causes disturbances. These facts agree with the observations I have made in regard to the health of my patients, as affected by atmospheric electricity. From these observations I conclude that a certain amount of nervous disorder, as well as a power of resistance, are associated with positive electrification. As in many other cases, there is, therefore, in this instance the possibility of having too much of a good thing.

Unhealthy symptoms, unfavorable to tissue-change, accompany negative electrification. Feelings of fatigue and lassitude, exhaustion of the nervous system, arrest of perspiration, loss of tone in the blood-vessels, accompany negative electrification. Congestion, bilious and apopletic attacks and hemorrhages are the results. The development of bad gas, processes of decomposition, and increase of bacilli are the accompanying phenomena. Certain forms of disease, as angina, peumonia, herpes, may, to extents depending on local conditions, increase with negative electricity, and seem to be related to the souring of milk, the decomposition of meat, and the development of bad smells in the street gutters and drains. If we say that the bacilli are the cause of these things, it may be true; but it does not explain why bacilli find more favorable conditions for their existence on some days than on others with equal warmth, moisture, air-pressure, etc. Dr. Schliep goes on to say that we get clearer notions if we consider the difference between animal and plant metabolism.

We know the astonishing effect of a close thunderstorm-day on vegetation, the sudden breaking forth of buds, leaves and flowers, the quick development of the young seed, and the sometimes rapid growth of such plants as asparagus. Light, warmth and moisture are of course the first conditions. The observation of this remarkable phenomenon gave rise to an interesting experiment of Becquerel. He selected four hyacinth roots of equal size and sort, which he put in a weak salt solution, two in a frame of glass, the third in a frame of zinc, and the fourth in a frame of copper. The copper and zinc were attached to each other by a wire. The vegetation developed most at the negative pole, less in the neutral frame, and was least at the positive pole. It seems that the roots of plants need a negative electric medium, and the crust of the earth is constantly negative. What increases the tissue-change in plants, decreases that of the animal organism. Thus, very often, days good for vegetation become tiresome for us. Walking in the streets causes great fatigue. All animals are tired on these days. They are the days of negative atmospheric electricity, days on which the bacilli are triumphant, wounds become septic, and germs of epidemic diseases find favorable conditions for development. It will concern bacteriology to pay attention to the facts. In balneo-meteorology, the most important object is the influence of atmospheric electricity on the anomalies of the constitution. From its better study we shall be able to derive hypotheses for our hygienic and therapeutic study, and besides the importance of geographical position, warmth, moisture, etc., atmospheric electricity will also play an important part in the classification of climates. We shall not only have to distinguish between land and sea-climates, wet and dry climates, cold and warm climates, but we shall also have to characterize a climate by its electrification and define with greater exactness the terms "relaxing" and "bracing."

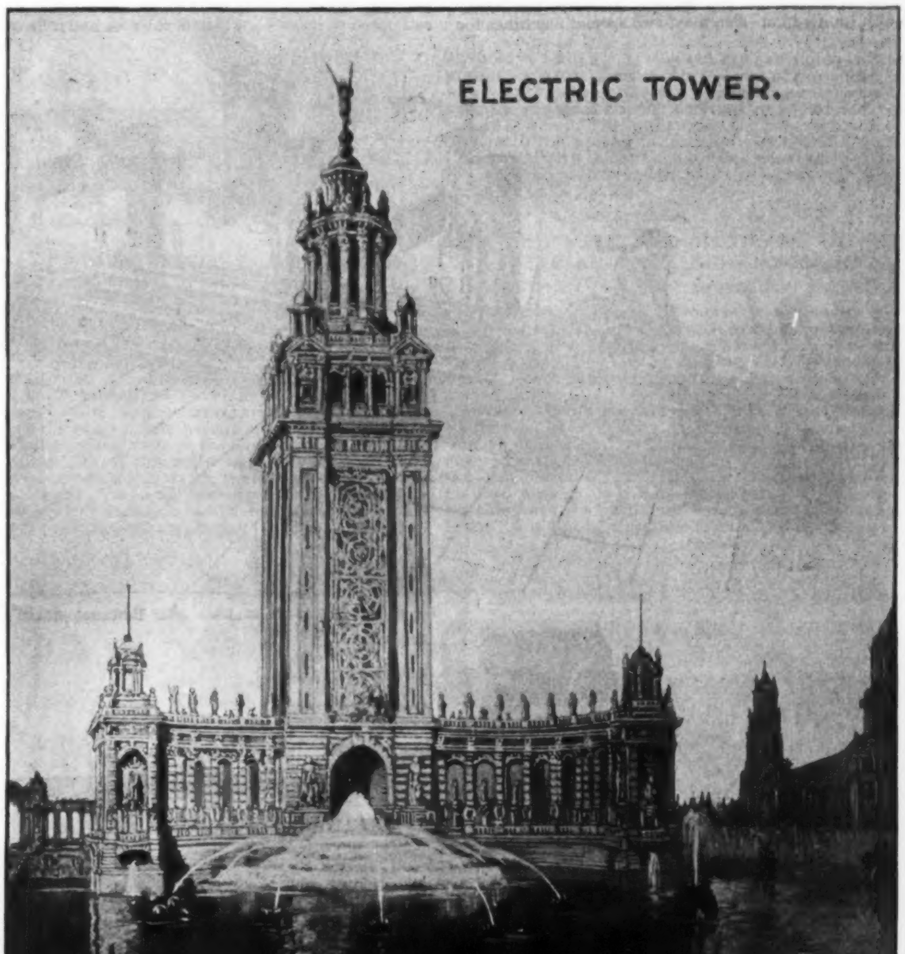
Perhaps we shall also be able to speak of a "spending" and a "saving" climate. We must not separate one characteristic of the climate from another and prefer it; in nature all phenomena work more or less together, they depend on one another and exercise mutual influences on one another. The electric conditions of the air are indicated by other meteorologic records, and hence we have important sources of information which ought not to be neglected, as our methods of making direct electric observations are not yet satisfactory. One can, from the daily increase or diminution of pressure, warmth and moisture of the air, say something of its electrification.

In this connection it is of no importance whether the barometer is high or low, but whether it rises or falls. It is not important to know whether the moisture of the air is great or not; it is important to know whether the moisture decreases or increases, whether the process of condensation or of evaporation prevails.

Dr. Schliep here describes at length the meaning of dew-point in hygrometric observations. He exhibited also a reduction disc made by Lambrecht, of Göttingen, a sort of circular slide rule, to facilitate the reduction of observations. He showed that the atmospheric electrification becomes negative if the average temperature and dew-point rise and if the barometer falls at the same time. If, however, the temperature and dew-point fall whilst the barometer rises, one may assume a positive electrification. He pointed out on the curves which represent his registrations at Baden during the previous ten years, that the air-pressure on one hand, and the temperature and moisture on the other, altered mostly in opposite directions. It was noticeable also that an exceptional steadiness for a few days was accompanied by the reverse of these movements as soon as the lines went far asunder. The graphic representations of meteorological phenomena show more than one would think at first sight. More plainly than lists of numbers, they allow a comparison of climatic conditions of different years or of certain periods with the statistics of the prevalent diseases during those periods.

Without a good graphic representation such statistics are never complete, however valuable the material which has been collected may be. Thus, for example, consider the work of Hippius, published in the Archives for Clin. Medic. vol. xi., about dysentery and meteorological influences upon it, in which there was an inquiry about the relation between meteorological changes and bleedings of the lungs with no apparent result. May not the failure of this inquiry be due to the fact that the meteorologic information was incomplete?

Dr. Schliep finishes his paper by pointing out the importance of the general meteorological observations at watering-places being under a central governmental control. The health resorts ought not to rest until they have obtained this aid from the government. But he distinguishes general meteorology from the simple kind of observation which it is in the power, and ought to be the duty, of every medical man to make for himself.—JOHN PERRY, in Nature.



ELECTRIC LAUNCHES IN VENICE.

"This week the Syndic and the members of the Giunta were invited," says the Venice correspondent of The London Globe, "to make a trial trip in one of the new electric launches which this summer are going to enter into rivalry with the steamboats, so hated by Mr. Ruskin, which now ply up and down the Grand Canal, and the result seems to have been most satisfactory. The launch is about eighteen yards long by three and one-half broad, and is made to carry comfortably fifty passengers. It is of graceful shape, and built so as to displace but little water, and the undulation produced is so small as to be smoothed out before it can reach the houses and rivas on either side. The launch is fitted with 108 accumulators, and the ordinary speed is seven miles an hour, though it can do nine in case of need. It is arranged that on June 1 next two lines of service shall be opened, the one between the station and the rialto, the other between the Piazzetta and the Lido, touching at the Public Gardens, and the price is

to be ten centimes a course. It would be a great benefit to Venice if, in this case, electricity should win the day over steam, for the puffing little tramvia, as the Venetians call the steamers, do worse harm than merely robbing the gondoliers of their passengers, for the violent wave caused by them as they rush along is destructive to the gondola itself. In old days a gondola would yet be hale and hearty at fifteen years old, but now at seven it is worn out. The steamboat wave and the backwash dash the gondolas against each other and against the piles and the steps of the ferry piers, dislocating their slender sides, and starting their fastenings. A gondola thus quickly loses its graceful curve and acquires an ugly flat one. Nor is this all the harm done by the steamers. When Mr. Ruskin spoke of the damage done by the wave cast off behind them as they bustle along to the foundations of the palaces, people in England laughed and accused him of exaggeration; but he was right, as those living in Venice well know, for water doorsteps and wall foundations are continually giving way, and reparations have to be made every ten or twelve years where once they were not required in half a century."

RAILWAY CARRIAGE MAKING MACHINERY.

The East Indian Railway Company has just had constructed for it by the Miley's Machine Tool Company, Limited, of Keighley, two special machines for dealing with the sole bars and cross stays of carriage underframes, of which we give illustrations. One of them, shown in Fig. 1, will mill the ends and drill the webs simultaneously. It is capable of dealing with channel bars 32 feet long by 10 inches wide, and 3 inches deep; the milling heads being adjustable to the ends square, or at an angle of 45°. When dealing with square ends only, the chucks are arranged to take them in pairs, which saves time in the milling, and by doing both ends simultaneously, without moving the milling heads, the cutting of all to a uniform dead length, whether square or otherwise, is ensured.

The radial drills cover the whole bar and will drill holes in any part of same, 1 inch diameter, in 30 seconds. The pillars are not adjustable, but are fixed and bolted to the side of main bed plate. The milling heads, however, are adjustable along the main bed by rack and pinion, and will mill any shorter lengths down to 3 feet long. The bed is cast with a trough running its full length, which collects the lubricant and empties it into tanks which are cast on each end. It is 40 feet long, and is made in two lengths.

Each milling head has its own pump, a separate pump of larger capacity being provided for the six drills. The milling and drilling heads can each be started or stopped independently by means of square toothed clutches and handles brought to the front of machine. The weight of the machine all complete, with its countershafts, is about 25 tons. Fig. 2 shows a machine which, so far as its adaptation for milling is concerned, is exactly like that shown in Fig. 1. It is, however, without the drilling heads, and is also made shorter, and is intended for dealing with the cross stays, while the other machine deals with the longitudinal bars. It will deal with channel bars up to 10 feet long, by 10 inches wide and 3 inches deep, and weighs complete about eight tons. We are indebted to The London Engineer for the article and engravings.

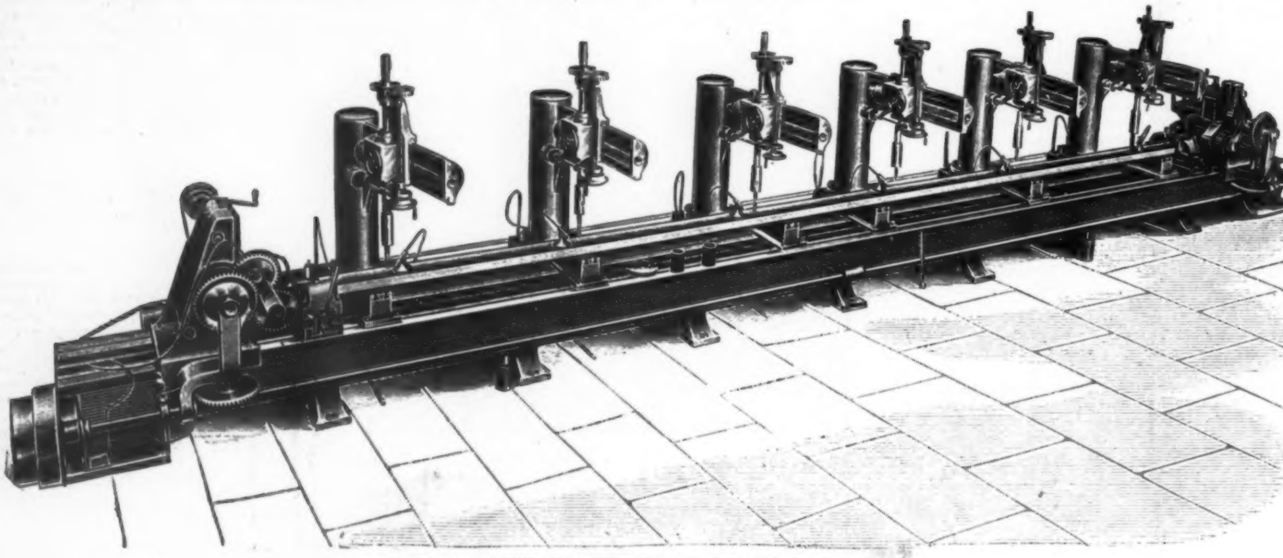


Fig. 1—MACHINE FOR MILLING AND DRILLING SOLE BARS

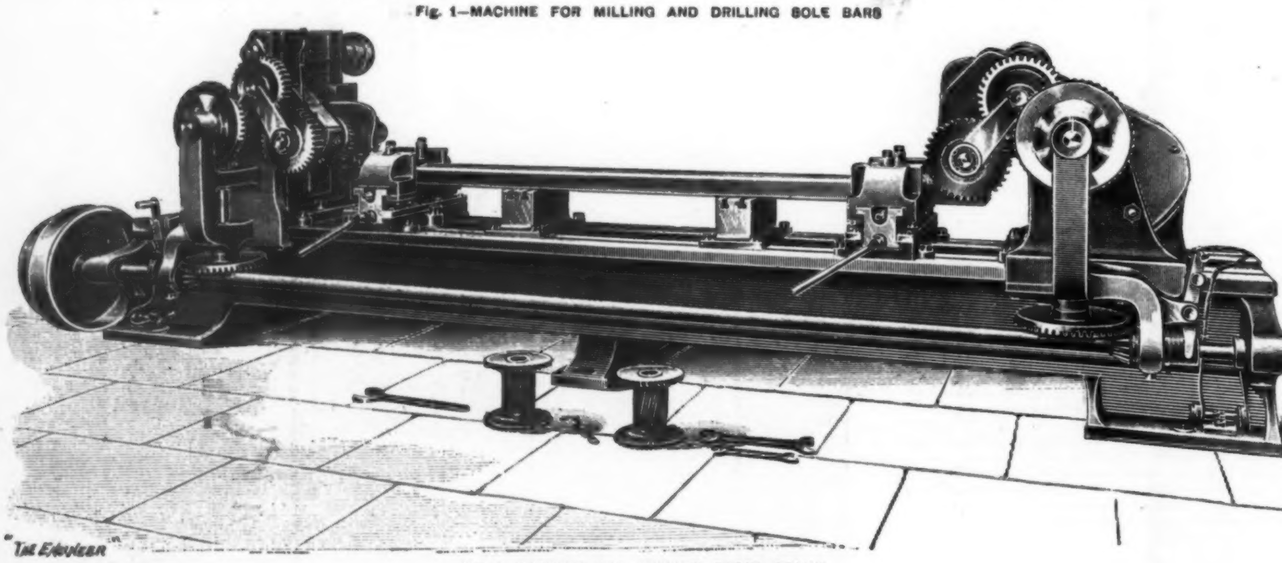


Fig. 2—MACHINE FOR MILLING CROSS STAYS

RAILWAY CARRIAGE MAKING MACHINERY.

THE RAILWAYS OF AFRICA.

The present interest which attaches to everything relating to the development of Africa renders the article by Herr H. Claus upon the railways of Africa, appearing in a recent issue of Glaser's Annalen, especially timely, and a rather full abstract made by Engineering Magazine is therefore permissible.

Herr Claus first discusses the political condition of Africa, showing that apart from the three small republics of the Transvaal, the Orange Free State, and Liberia, and the two native states of Morocco and Abyssinia, the whole lot of the continent, with its 11,584,000 square miles area and 140,000,000 inhabitants, is under the rule of various European nations. It is estimated that seven-eighths of the area and nine-tenths of the population have come under European control, the greater portion of this being governed by England. Broadly, the British portion includes the Nile Valley, the territory from the Cape to Lake Tanganyika, the island of Zanzibar, and the sources of the Niger; an area of nearly 3,700,000 square miles, with a population of 58,000,000. The portion controlled by France includes Algiers and Tunis, the country about Lake Tchad, the fertile Congo basin to the upper portion of the White Nile, also the territory between Abyssinia and Bab-El-Mandeb, and the island of Madagascar, a total of nearly 3,000,000 square miles, and a population of 27,000,000.

The third in point of magnitude includes the territory controlled by the King of the Belgians, the Congo State, 865,000 square miles area and a population of 25,000,000; followed by the German possessions, which are in three groups, Togo and the Cameroons in the West, the large area between the mouth of the Kunena and the Orange River in the Southwest, and in the East the territory from the Indian Ocean to the great lakes; the whole number being about 861.000 square miles area, with 6,000,000 population. The Portuguese possessions include Delagoa Bay, the Mozambique coast, and the lower valley of the Zambezi, on the East, and on the West the province of Angola, the area being 849,000 square miles, and the population about 4,500,000. Italy possesses the territory of Massowah, on the coast of the Red Sea, with an area of 400,000 square miles, and a population of 2,000,000, and Spain controls a similar territory of the Atlantic coast south of Morocco, with an area of 212,000 square miles and 500,000 inhabitants.

The development of railways in all these territories has thus far been small, but many projects have recently been made public and a considerable portion of the work executed.

Starting from the French colonies of Algiers and Tunis in the northwest, and following around the coast we find short spurs of railway extending into the interior, this being the most natural way of opening up the interior of such a continent. In Algiers and Tunis there were, at the close of 1897, 2,475 miles of railway, of which 2,150 miles were in Algiers and 325 miles in Tunis, in which latter colony 560 miles were also under construction. In Senegal there is a coast line from St. Louis to Dakar, a distance of 164 miles, and in the French Soudan the line from Kayes to Tulimandio, a distance of 335 miles, connects the upper navigable waters of the Senegal with those of the Niger, this connection greatly strengthening French power and influence in the western Soudan. A number of projected roads from points on the Guinea coast to interior towns are among the plans for the development of this portion of the coast, while the great project of a Trans-Saharan railway, extending from Algiers and Tunis down to Lake Tchad and to the navigable waters of the Niger, is well known.

The Congo is navigable as far as Matadi, above which point the rapids known as the Livingstone Falls prevent navigation for a distance of 186 miles. Above these the Congo and its tributaries form a net-work of navigable streams of more than 9,000 miles in total length. The Congo Railway Company has constructed a railway extending 236 miles from Matadi to Dolo, on Stanley Pool, this road, which was opened in July, 1898, taking the place of a difficult path by the falls, the journey over which formerly occupied 20 to 30 days. Plans for other railways in the Congo State have been discussed, but these have not yet taken definite shape.

In the Portuguese colony of Angola there has been under construction since 1888 a railway extending from Sao Paolo de Loando, on the coast, to Kasange, on the Kwango, a tributary of the Congo; nearly 200 miles of this road being now in operation, and other railways are projected in this colony. There has also been some discussion about a railway connecting the colony of Angola with the Portuguese possessions at Mozambique, on the east coast, but such a road would necessarily pass through the British territory of Rhodesia. Since the work is practically in the control of British

capital and the construction undertaken by British labor, this point offers no insuperable difficulty and the line now under construction from Mossamedes to Huilla is to be prolonged through Rhodesia and connected with the completed railway from Beira to Salisbury. It is also reported that an agreement has been made between England and Portugal for the construction of a harbor at the mouth of the Kunene, and the building of a railway from thence eastward to Buluwayo. In German southwest Africa a railway is being constructed by the German government to extend from the mouth of the river Swakop to Windhoek, and 60 miles of this road have been in operation since April, 1898.

The most important portion of the railways of Africa, however, are those in the British Cape Colony, the Orange Free State, and the Transvaal Republic. These have a total length of 4,350 miles, the main western line extending from Cape Town to Buluwayo, and beyond to Salisbury, where it connects with the Portuguese line from Beira. Branch lines also connect with Port Elizabeth, Port Alfred, and Port Natal. Johannesburg and Pretoria are connected with the Indian Ocean by two railways, one running to the Portuguese harbor of Lorenzo Marquez, and the other to the port of Durban, in the British colony of Natal.

It is in connection with the Egyptain railway up the Nile Valley from Alexandria to Cairo, and beyond to Khartoum, that the proposed Cape-to-Cairo route has been considered, the whole being intended to form a mixed rail and water route through the whole length of the continent. Herr Claus gives a detailed tabular statement of the length of the various portions of the route his map showing very clearly the completed and proposed portions.

In British East Africa, an important piece of railway is being constructed from Mombassa to Port Victoria, on the Victoria Nyanza, this road being more than 600 miles long, passing over an elevation of more than 8,500 feet, north of Mount Kilimandjaro, and when completed it will enable direct communication to be made from the 25,000 square miles of area of the Victoria Nyanza to the sea.

At the beginning of 1899, 125 miles of this road were in operation.

Herr Claus discusses briefly a number of minor projects for railways from points on the coast into the interior, all of which are of interest in connection with the general opening up of the continent, but for further information respecting these reference must be had to his excellent map and article.

AUTOMATIC LUBRICATOR.

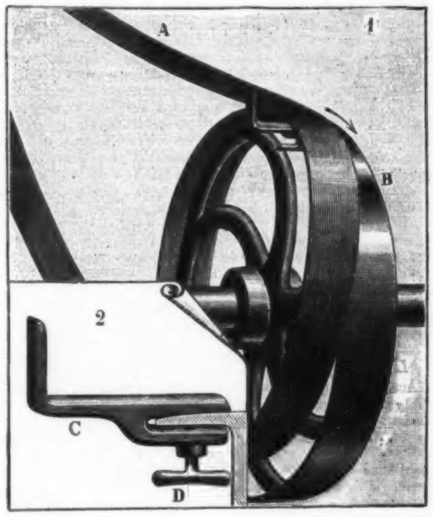
WE illustrate an ingenious automatic lubricator intended for the supply of solid lubricants, which has recently been brought out by the Aktiebolaget Lubrikator, of Garfvaregatan 13, Stockholm. Solid lubricants have certain advantages of their own, being

FIG. 1.

FIG. 2.

AUTOMATIC LUBRICATOR FOR SHAFTING.

cleanly, economical, and excellent reducers of friction. As usually applied, however, there is a difficulty in insuring a continuous and regular flow of the lubricant to the bearing. When the common screw cup is used, the cap has to be screwed down at frequent intervals, while the spring loaded lubricators tend to give a more copious feed of the lubricant when freshly filled than when nearly empty. With the gravity feed lubricators, on the other hand, in which a weight resting on the grease forces it on to the bearing, there is, in the first place, a certain liability of sticking fast due to grit or other foreign body finding access to the interior; and, secondly, the rate of supply varies with the temperature. With the lubricator illustrated the feed is positive, and can be altered within wide limits as may be needed by particular cases. The feed is given by a plunger above the grease in the cup, fed



DEVICE FOR MOUNTING DRIVING BELTS.

1. Arrangement upon the pulley. 2. Details of the hook.

down by a screw which is turned round by the ratchet-wheel shown above the cup in figure. The driving pawl is vibrated by a crank on a shaft turned by the friction feed wheel clearly shown in Fig. 2. This wheel is in turn rotated by a swinging arm, carrying a friction pawl as shown, and having at its free end an eccentric roller, which rests on the shaft to be lubricated. The eccentricity of this roller can be varied at will, and consequently a greater or lesser feed given to the friction wheel. The arm, moreover, being extensible, provides an additional means of regulating the feed, since it is obvious that the longer the arm the less the feed with a given eccentricity of the roller. The feed screw, we may add, works in a split nut, which can be opened when it is necessary to raise the plunger in order to fill the cup. The refilling is done from the bottom, the top of the cup being freed from the bottom portion by slacking the wing nut shown. In ordinary work, one charge of lubricant will last 300 to 400 hours. The rate of supply is, of course, unaffected by a rise of temperature, which would soften the grease, the feed being a positive one.—Engineering.

DEVICE OF MOUNTING DRIVING BELTS.

IN order to transmit the motion of the engine to the machines that it is desired to set in motion, it is often necessary in manufactories to make use of driving belts of very large size, which have to be mounted upon pulleys. Now, in most cases, the operation of mounting is performed by means of a cord provided with a slip-noose; but great care must be taken to loosen the cord at once as soon as the engine is started. It may happen, however, that the cord will not slide easily, and in such a case the belt may be damaged. In reality, the operation is attended with many dangers.

M. J. Mollon, superintendent of the weaving works of M. J. B. David, at Boen, having had considerable experience with such inconveniences, has devised an apparatus that permits of easily mounting belts without any danger, and which is represented in the accompanying engraving. It consists of a metallic rod, *C*, bent upward at one of its extremities in such a way as to form a rounded angle. In the horizontal part of the device is formed a recess for the reception of the edge of the pulley rim, to which the apparatus is fastened by means of an adjusting screw, *D*. In order that the apparatus may operate properly, the distance of the vertical arm of the rod to the external edge of pulley should not be greater than half the width of the belt.

By means of this little device, which is easily constructed, a belt may be very readily put in place. The apparatus is first fastened to the rim of the pulley by means of the screw; the belt is placed upon the hook; then the engine is started, and the belt slides upon the pulley at once. The pulley may make several revolutions with the apparatus attached without the latter interfering with the belt in any way whatever.

For the above particulars and the engraving we are indebted to La Nature.

THE CARE AND HANDLING OF INFLAMMABLE SUBSTANCES.

By JOSEPH F. HOSTELLEY.

PHARMACIES are not infrequently visited by fire, which can ofttimes be attributed to injudicious storage or careless handling of inflammable and explosive substances. On the part of a great number of pharmacists there is a distressing disregard for the dangerous nature of some of the substances carried in stock, elements that have a great affinity for fire. Eternal vigilance is the price of safety. Turn a deaf ear to these words of wisdom when handling inflammables, you give the daily newsgatherers pabulum for their gazettes. It is not only essential that the pharmacist be vigilant of his own actions in this regard, but he must keep a watchful eye upon the movements of his assistants. If the "boy" be of a grammar-school age, it behooves every other attaché of the pharmacy to be his and their own guardian angel, so to speak. The pharmacist who will permit a youngster to roam about in a cellar or "back room" in which are stored inflammables and explosives, at his own sweet will, is courting a conflagration, commercial ruin, and possibly bodily harm to one or many persons. The same is true of him who hands a lamp or candle light to an express or delivery man, with a box or barrel, with instructions to "just put it in the cellar; you know

where it goes," or to "look about; you'll find some empties down there." And these cases are facts, not fancies.

System in the handling of inflammable or explosive substances and compounds is powerful in preserving the person and property from injury, and insuring to the pharmacist a sense of safety from the evil effects that often follow reverse methods. There should be a definite locality in the establishment for keeping agents of this type, and here and nowhere else, each and every one should at all times be found. No putting benzine in the rear of cellar, a vial of chloroform near the street exit, and a vessel of phosphorus under the stairs, with, possibly, ethers on a lower shelf in the "back room." Have that proverbial place for everything inflammable, and be able to always find everything in its place. Teach clerks the import of such a regime. Concerted and concentrated effort along this line tends to lessen the possibilities of a casualty and exerts a potent influence toward the elimination of danger arising from scattered containers of inflammables, one of which may happen to rest just in the proper position to be ignited by a lighted match dropped inadvertently, a spark from the heater, the cigar of a careless worker, by mice gnawing matches, or by an overtipped lamp.

In a sepulcher one treads with awe because the very appearance of the tomb impels a reverential step. Now, if somewhere about the establishment there was a special fireproof apartment, a room distinct and distinctive wherein to store the commodities of which we write, a foot would not be stepped within its threshold without a realization of the dread nature of its contents. Its peculiar construction and comparative isolation would impress one with the fitness, nay, necessity for cautious movements and prudence. Such a department would necessitate a greater or lesser demand upon the exchequer, to be sure; but would not its services, significantly valuable, merit this expenditure? Surely an ounce of prevention is worth a pound of cure. Would it not be far wiser, then, to spend a few dollars on such a precautionary measure, than to lose hundreds by a fire that might have been averted? If not, then the whole system of property and life insurance is a fallacy, and insurance corporations, frauds.

Let us tell a succinct story brought to mind by several actual happenings: There is a demand in the store for a certain inflammable substance; it is somewhere in the cellar; the time of day is dusk or dark; the cellar is poorly lighted or the day is gloomy; a lamp or candle is taken in hand; a search is instituted below among a heterogeneous list of items; the search consumes some minutes, probably because of someone else "losing" the desired matter, and the object of the quest does not materialize; haste now oversteps prudence; the movements of the light become erratic; there is a flash, a flame, and an after investigation, which finds that misplaced item of stock the cause, one way or the other, several hundred dollars loss the effect. Which, think you, would have been the cheaper, a special fireproof department for such commodities and system, or what followed the absence of both these expedients?

The whereabouts of the apartment we suggest would, naturally, be governed by circumstances, by the facilities at command. Many impulses suggest the cellar as a good and usually convenient locality wherein inflammables will most likely be beyond the casual fire-brand or that "defective flue" so often sinning and being sinned against. The cellar is a decided vantage ground because of the earth or cement floor and the stone walls. Here a stone or brick and mortar vault could be designed. A corner affords the advantage of two boundaries or walls ready constructed. Little wood should be employed in its erection and accoutrements. A door of sheet iron would be preferable. A pane of glass may be set into one wall, but little or no sash of wood should be seen. Interior shelving could be of boards covered with asbestos cloth or tin, or of heavy plate glass. If practicable, an incandescent globe should constitute the means of affording light therein. If a hand illuminant be necessary, a tallow or wax candle seems commendable because, in itself, there is not, as in the case of the lamp bowl, a substance to greatly endanger surrounding objects, if it be overturned. A candle lantern is a clever device. A gas jet has to its discredit the heat generated by the ignited gas.

A fair substitute for a fireproof vault would be a capacious closet or room of boards, built into one corner of the cellar. This would be less expensive than the former. Boards for its construction could be obtained from packing boxes. Many of those from bottle cases are three feet some inches in length. As they are to be covered and protected by asbestos cloth or tin on both sides, they would require no planing. When completed, both interior and exterior woodwork of closet should be completely and fully hidden beneath a coating of non-combustible material. Shelving should be likewise made insusceptible to flame.

When completed and stocked, in this department will be found such inflammables as the following: Alcohol, benzine, chloroform, carbon disulphite, ether, acetic ether, spirit of nitrous ether, ethylic aldehyde, ethyl bromid, ethyl chlorid, phosphorus, etc. Liquefied gases in cylinders, such as carbonic acid gas, oxygen, etc., should be kept herein; also light petroleum oil for supplying lamps for illuminating or stoves for heating. Some pharmacists make a specialty of preparing powders, etc., for pyrotechnic displays on the Fourth of July, to herald the election of certain men to public office, and for diverse local celebrations. Between festivities these fireworks may be preserved in this compartment for inflammables.

No matter what may be your method of storing inflammables, it should be made an immutable rule, the violation of which is a pharmaceutic misdemeanor demanding a severe censure—never to remove the stopper from a vessel containing such a dangerous substance, in the neighborhood of a lamp, candle, or gas flame. During the hours of sunlight, such a substance is not to be transferred from one container to another in a dark room or cellar, where an unsafe medium sheds light. Let the vessel and its desired contents be taken where the sun may aid the eye and hand to pour, weigh or measure. Insist that, with exceptions really unavoidable, all such duties be done before nightfall. The replenishing of shelf bottles should not be delayed until daylight has waned. Lamps or oil stoves must be filled during the early hours. Procrastination in these matters is fraught with danger. Excelsior, paper waste, hay, or other matter greedy to grasp a spark or flame, must not be allowed to lie on the cellar floor in loose piles. Hot ashes should never be deposited in a barrel, cask, or box of wood; many fires are caused by ignoring this precaution. Care should be exercised in "banking" the heater fire for the night. When consuming rubbish in the heater, the latter should not be left alone many minutes.

This brings us to a consideration of fire-extinguishers applicable to the pharmacy. There are patent ones galore. The possibilities of carbonic acid are proverbial. Its potent properties as a fire fighter may be utilized in this way: Beneath a small trap door in the floor of the prescription department or "back room," a cylinder of carbonic acid is set securely upon a shelf at such a height that the flow of its contents can be controlled easily by one above the trap in the floor or by a person in the cellar. Thus one tank suffices for the protection of two departments of the store. To the cylinder is connected a section of rubber tubing or hose, hung at a point where it may be accessible both from above and below. Here is another idea: A fresh water pipe running beneath the flooring might be tapped, a spigot affixed to it, a hose attached, to be hung as described for tank of acid, and the trap cut in floor. Such a scheme as this, or that preceding, secures an expedient to always and quickly answer the exigencies of the hour of need. This end might be furthered by distributing about the premises, in readily accessible positions, syphons of soda, or hand grenades. The latter are easily prepared by the pharmacist from familiar formulas and several flasks.

The peculiar affinity calcium carbide has for moisture, and the specific effects of such an equation, should not be overlooked. Keep calcium carbide in a dry atmosphere. When phosphorus is used but seldom, it is destined to pass out of mind. But don't let it rest unnoticed in an out-of-the-way nook of the cellar until the water in which it is immersed evaporates and the phosphorus ignites. Accidents have resulted by forgetting this principle. Haste precipitates many unforeseen and unfortunate events. Whatever may be the demand upon your time, never fail to recork a vessel containing an inflammable, immediately after handling. If any be spilled on the floor or over other objects, eliminate all possible danger from fire at once and inform other attaches of the pharmacy of the accident, that they may be cautious for some little time after when approaching this locality with a light in hand.

It is well to speak a word of warning to purchasers of benzine. A caution label may be overlooked; verbal advice is potent and it seems to always have an echo that carries weight. In a conspicuous position in the cellar, at the foot of the steps to street, where wagon and dray drivers may see, hang this placard: "NO SMOKING." And after it has been hung, remember its purport yourself.

Let the pharmacist, in the matter of protecting his property from fire, learn to be cautious, painstaking, systematic. Teach the principle of prudence to your clerks, and practice what you preach. Rather be accused of timidity than temerity.—The Pharmaceutical Era.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Agricultural Implements in Eastern Brazil.—Consul Furniss, of Bahia, on January 17, 1900, writes to an Illinois company as follows:

Very few agricultural implements are used in this district.

Some time ago, I made a trip to the most fertile section of this consular district, where coffee, sugar cane, tobacco, etc., are raised in great quantities, and I was surprised to note the entire absence of modern agricultural implements. The ground is prepared for planting by turning it up with a spade, but more often with a crude hoe resembling our grub hoe, or with a pick where the soil is particularly hard. A crop once planted is not bothered much by cultivation, the coffee being full of weeds and other vegetation and a heavy growth often obscuring the cane. The little cultivation that is done (more particularly with tobacco) is effected with a broad hoe, of the type long ago used in the cotton fields of the south of the United States.

In many parts a plow is unknown; in fact, I can find but one district that ever attempted its use, and that was the sugar-cane section, under the management of an English company, and the plows brought out have been allowed to rot and rust, because the natives could not be induced to use them.

Such farm implements as seeders, harrows, planters, drills, cultivators, hay loaders, corn huskers, and the like are entirely unknown here. Indeed, there could be no use for many of these things, because little in the way of grass or vegetables is raised, the supply being imported; the corn and hay from Argentina, the potatoes from Portugal and possessions and Germany, the beans from Southern Brazil, Argentina, and a small quantity from the United States, though there is plenty of land in this district upon which all these products could be raised.

As Brazil is nearly as large as the United States, I cannot speak as to the chances for the implement trade in the whole country, but have to confine my remarks to this consular district, which includes the States of Bahia and Sergipe. I understand that in Rio Grande do Sul and Santos they devote more attention to modern farming.

The whole of the Argentine Republic offers a good market for all kinds of agricultural implements.

American Buggies in New South Wales.—Consul Goding, of Newcastle, under date of January 16, 1900, writes that through the personal efforts of that office buggies manufactured in the United States have been introduced. By the outgoing mail there were ordered six different styles of buggies. The orders are each accompanied by a draft for the amounts. Mr. Goding trusts that this will lead to a considerable business in buggies, etc., between the colony and the United States.

Colonial Training in Belgium.—Consul Roosevelt writes from Brussels, February 23, 1900:

In view of the increasing prosperity in the Belgian Kongo, this government is considering means of interesting the people in the subject of colonization. One of the most practical is the recent establishment at the Horticultural School, at Vilvorde, of a special department for the training of students who intend to seek a fortune in the colonies. There will be practical demonstrations of the sort of buildings a settler must construct and instruction in rules of sanitation. The cultivation of indigenous plants, as well as of European vegetables and plants, the best methods of gathering crops and transporting them to market where there is a demand for them, and the way to treat the native population, from which the labor supply must be drawn, will all be dealt with.

Colonial School in France.—Consular Agent Harris, of Eibenstack, under date of February 12, 1900, writes:

A colonial institute is to be opened in Marseilles to prepare young men to fill positions in the French colonies. Expeditions of students will be sent out at the expense of the State, and commercial houses will receive the information thus obtained in the form of detailed reports. Instruction will be given in botany, zoology, natural history, colonial geography and history, etc. There will be a museum of plants, minerals, etc., so that the student may become acquainted with the actual products of the colonies; also a school of medicine to familiarize him with diseases peculiar to tropical countries. It is probable that arrangements will be made for teaching Oriental languages. For grounds and buildings, the city of Marseilles has donated $193,000.

Openings for Americans in Nicaragua.—In answer to inquiries by a New York correspondent (to whom the letter has been sent), Consul Donaldson, of Managua, on February 10, 1900, sends the following information:

As teachers and professors in government and other schools in Nicaragua, there is really no opening for our young graduates. Salaries here are insignificant and customs so different that Americans have never proved successful. The salary of a principal here is 50 pesos, or about $17, per month.

American physicians and surgeons are successful here, but no part of the world is more crowded with them than the large towns of Nicaragua. Hundreds of the native young men study medicine in the United States and return here to practice. They understand better their own diseases, customs, and people than a foreigner could, and the majority of the people prefer them. Dentists, however, are scarce, and whenever an American dentist comes, he does a good business and can charge remunerative prices.

Engineers of all kinds are the most successful of any professional men in these tropical countries. Very few natives follow that vocation, and most of the engineers employed by the government are foreigners. An engineer's salary at the start is from 250 to 300 pesos ($80 to $100 in United States gold) per month.

Business here is the favorite occupation for all natives. The wives of officials, of planters, of lawyers, of doctors, and even of politicians, have their little shops and thus crowd every town with stores. Salaries for clerks are not worth the consideration of any foreigner.

The German Jute Industry.—Vice-Consul-General Hanauer sends the following from Frankfort, February 6, 1900:

The number of spindles working up jute yarns has increased from 73,226 in 1890 to 135,000 in 1899. The increase in the import of raw jute has not kept pace in this ratio, but jute yarns from abroad have obtained a larger market in Germany. The annual production of jute fabrics in Germany now amounts to 50,000,000 marks ($11,900,000) in value. The import of jute bags having in late years largely increased, the German manufacturers are asking for a change in the tariff rates on the bags, so that in future jute bags imported for baling sugar intended for export shall be made to pay duty. These manufacturers are now negotiating for the creation of a trust of jute manufacturers.

American Wheat for Macaroni.—The Bureau of Foreign Commerce has received another letter from Mr. James B. Simpson, of Dallas, Texas, in regard to the wheat which was sent to France to be tested as to its fitness for use in the manufacture of macaroni and similar edible pastes. Mr. Simpson says, in part:

It has been demonstrated beyond question that all Northern Texas is perfectly adapted to the growth of the hard, glutinous wheats now in such great demand in France and Italy. The grain I transmitted through your kindness to Consul Covert, of Lyons, upon analysis shows the value of this hard wheat to Texas. With the port of Galveston now open, giving us easy access to Marseilles, this wheat is calculated to revolutionize production here.

But the difficulty lies in this: Our farmers here, through negligence, have mixed the hard and the starchy wheats, and we find it almost impossible to obtain the pure hard grain. I did the best I could in sending Consul Covert the 2 bushels for analysis, and in sending 5 bushels at your request to the Paris Exposition, but all had some grains of soft wheat in it. If the farmers here could obtain the Taganrog hard wheat for seed, it would be but a few years before Texas would control the French and Italian markets in this hard wheat.

Index to Advance Sheets of Consular Reports.

The Reports marked with an asterisk (*) will be published in the Scientific American Supplement. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted.

TRADE NOTES AND RECEIPTS.

Pegamoid—The following receipt for the mixture of a coating for bookbinder's paste board is said to be very similar to the composition of pegamoid. Camphor, 100 parts; mastic, 100 parts; bleached shellac, 50 parts; gun-cotton, 200 parts; aceton, 200 parts; acetic ether, 100 parts; ethylic ether, 50 parts.—Papier Zeitung.

Sawdust in Bran.—For the detection of sawdust in bran, Le Boy recommends the use of a solution of 1 gramme of phloroglucin in 15 ccm. of alcohol, 15 ccm. of water and 10 ccm. of sirupy phosphoric acid. Place 2 ccm. of the solution in a small porcelain dish, add a knife-point-full of the bran and heat moderately. Sawdust is dyed red while bran parts only seldom acquire a faint red color. By a microscopic examination of the reddish parts, sawdust will be readily recognized.—Chemiker Zeitung Repertorium.

Lead Poisoning.—To gain a knowledge of experimental lead poisoning C. Oppenheimer examined the distribution of the lead in the organs of five rabbits, which he poisoned gradually, within twenty-one days by subcutaneous administration of a 2 per cent. lead acetate solution. He found that the brain, bones and spinal marrow, with little deviations among themselves, contained a relatively large amount of lead, while liver, kidney, and muscles exhibited a much smaller percentage of lead and the blood only very little lead, hence always took the last place.—Lack-und Farben Industrie.

Empress Elizabeth Water for Perfuming.—Digest for a few days: Rad. Angelicae, 1 gramme; Caryophyll, 3 grammes, Fol. Salviae, 2 grammes; Rhiz. Iridis, flor, 1 gramme; Rhiz. Vedoariae, 1 gramme; Rhiz. Galangae, 1 gramme; Radic. Cyperi 1 gramme; Lign. Santali citrin. 1 gramme; Radic. Lavandulae 0·425 gramme; Rhiz. Calami 1 gramme; Nuc moschat. No. III; Cort. Aurant, dulc. rec. No. IV; Cort. Citrirecent No. IV; Cort. Cinnamoni, 4 grammes; Herb. Thymi vulgar, 2 grammes; Ol. Rosmarini, 0·5 gramme; Spirit 30 per cent. 250 grammes; Aqua Meliss, 30 grammes; Spirit Flor. Auranti i 10 grammes, and distill completely. This is one of the best preparations for the skin, wash, etc.—Zeitschrift für Kosmetik.

Gilding of Glass.—In order to produce a good gilding on glass it is necessary, according to Aufrecht, that the gold salt employed be free from acid, then proceed as follows. Prepare three solutions, viz.:

1. 20 acid-free gold chloride in 150·0 distilled water.
2. 5·0 dry sodium hydrate in 80·0 distilled water.
3. 2·5 starch sugar in 30·0 distilled water, 20·0 spirit of wine and 20·0 commercial pure aldehyde (40 per cent.). These liquids are quickly mixed together in the proportion of 200, 50 and 5 ccm., whereupon the mixture is poured on the glass previously cleaned with soda solution, and the gilding will be effected in a short time. The gold coating is said to keep intact for years.—Pharmaceutische Zeitung.

The Famous Chinese Cement "Shio Liao."—Under this name the Chinese manufacture an excellent cement which takes the place of glue, and with which gypsum, marble, porcelain, stones, and stoneware can be cemented. It consists of the following parts (by weight): Slacked powdered lime 54 parts, powdered alum 6 parts, and fresh, well-strained blood 40 parts. These materials are stirred thoroughly until an intimately bound mass of the consistency of a more or less stiff salve is obtained. In paste form this mass is used as cement, in a liquid state it is employed for painting all sorts of articles which are to be rendered waterproof and durable. Cardboard covers, which are coated with it two or three times, becomes as hard as wood. The Chinese paint their houses with "shio liao" and glaze their barrels with it, in which they transport oil and other greasy substances.—Farben Zeitung.

Production of Earth Colors.—The invention mainly concerns the production of black and earth colors. Ferruginous earths, especially loam, are heated with sulphur under exclusion of air, by placing loam with about 5 per cent. of sulphur in a crucible, closing it up with a lid and heating until the heat is uniformly distributed over the whole contents of the crucible. This causes the whole mass to assume a black color. The mass should be kept hermetically closed off until completely cooled and then furnishes a black and very cheap earth color eligible for many uses. It is of advantage to wash the loam before the heating with sulphur and to dry and finely grind it. Similar behavior is shown by ocher, sienna, bole, umber, etc. If the colors obtained are roasted with admission of air, entirely deviating shades are produced, the greyish black color from the loam turning intensely yellow, that obtained from ocher acquiring a fawn color.—Chemiker Zeitung.

New Varnish and Paint Remover.—Most agents for removing varnish and oil paint coatings owe their efficacy to the presence of caustic alkalies. But since the latter exercise a destructive action upon bodies of organic origin, the preparations containing caustic alkalies can only be employed to a limited extent and with the greatest care. They do not only have a decomposing influence upon the wood fiber, but their use is also quite dangerous owing to their strong caustic effect upon the human skin.

It has been found that the unpleasant by-effects of the caustic alkali can be completely obviated, while the dissolving power for the dry varnish and oil paint layer is yet materially increased, if a mineral oil is emulsified in the solution of the caustic alkalies. In order to maintain the oil lastingly in emulsion, the easily mobile mass is mixed with a sufficient quantity of an indifferent body, such as brick-dust, powdered pumice stone, sawdust, etc., thus a form highly suitable for application is that of a paste, is obtained. This paste constitutes a very efficacious and durable paint remover, which may be applied moist on any surface and exercises no deleterious action upon the fibers of the wood and the human skin.

For producing the new paint remover proceed as follows: — Dissolve 20 kilos of caustic soda (98 per cent.) in 100 liters of water, mix the solution with 20 kilos of mineral oil and stir in a kettle provided with a mechanical stirrer, until the emulsion is complete. Now add with stirring, 20 kilos of sawdust and pass the whole through a paint mill to obtain a uniform intermixture.—Neueste Erfindurgen und Erfahruegen.

SELECTED FORMULÆ.

Cementing Celluloid and Hard Rubber Articles.—Celluloid articles can be mended by making a mixture composed of 3 part of alcohol and 4 parts of ether. The mixture should be kept in a well-corked bottle, and when celluloid articles are to be mended the broken surfaces are painted over with the alcohol and ether mixture until the surfaces soften; then press together and bind and allow to dry for at least twenty-four hours. Another cement for celluloid: Dissolve 1 part of gum camphor in 4 parts of alcohol; dissolve an equal weight of shellac in such strong camphor solution. The cement is applied warm and the parts united must not be disturbed until the cement is hard. Hard rubber articles are never mended to form a strong joint. The following is said to be the best cement for the purpose known: Melt together equal parts of gutta percha and real asphaltum. The cement is applied hot, and the broken surfaces pressed together and held in place while cooling.—The Keystone.

Absolutely Indelible Ink.—

Silver nitrate, crystals	5 parts.
Ammonia water	10 "
Sodium carbonate	7 "
Mucilage of gum-arabic	15 "
Boiling water	5 "

Dissolve the silver nitrate in the ammonia in one vessel, and the sodium carbonate in the water in another. Mix the two and finally add the mucilage, shake together thoroughly, and put the vessel in full sunlight and leave it there until the mixture turns brown. Names or marks, written or made with this ink, and afterward developed by passing a hot smoothing iron over the writing, or drawing, will last as long as most articles of clothing. In lieu of the hot iron, pressing the writing against the chimney of an ordinary kerosene lamp will fix it admirably.—National Druggist.

Nickel Plating.—There is no means of plating with nickel without a battery, so far as we know, which is applicable to popular use. There is said to be a way of forming a gaseous compound of nickel, which, when condensed, can be made to deposit the metal, but this is of no practical use, as the operation would be difficult and probably dangerous.

The battery process is simple enough, but even that cannot be successfully worked, we presume, without some practice. We give a brief account of the process which may interest others, if not our correspondent. It is taken from a lecture on electro-metallurgy, by James Brown, reprinted in The Circular for September, 1892.

The nickel bath is prepared by the following formula

Nickel and ammonium sulphate	10 parts.
Boracic acid	4 "
Distilled water	175 "

A sheet of nickel is used an an anode.

Perfect cleanliness of the surface to be coated is essential to success. With nickel especially is this the case, as traces of oxide will cause it to show dark streaks. Finger marks will in any case render the deposit liable to peel off.

Cleansing is generally accomplished, to quote the same author, "either by boiling in strong solution of potassium hydrate, or, when possible, by heating to redness in a blow-pipe flame to burn off any grease that may be adhering, and then soaking in a pickle of dilute sulphuric acid to remove any oxide formed during the heating. In either case it is necessary to subject the article to a process of scratch-brushing afterward; that is, long continued friction with wire brushes under water, which not only removes any still adhering oxide, but renders the surface bright."

To certain metals, as iron, nickel and zinc, metallic deposits do not readily adhere. This difficulty is overcome by first coating them with copper in a bath composed as follows:

Potassium cyanide	2 parts.
Copper acetate, in crystals	2 "
Sodium carbonate, in crystals	2 "
Sodium bisulphite	2 "
Water	100 "

Moisten the copper acetate with a small quantity of water and add the sodium carbonate dissolved in 20 parts of water. When reaction is complete, all the copper acetate being converted into carbonate, add the sodium bisulphite, dissolved in another 20 parts of water; lastly, add the potassium cyanide, dissolved in the remainder of the water. The finished product should be a colorless liquid.

Where a dynamo is not available for the production of a current, a Daniell's battery is to be recommended, and the "tank" for a small operation may be a glass jar. The jar is crossed by copper rods in connection with the battery; the metal to be deposited is suspended from the rod in connection with the positive pole, and is called the anode. The articles to be coated are suspended by thin copper wires from the rod in connection with the negative pole; these form the cathode.

We may add that it is said that if the nickel coating is thick it will peel off.—Druggists' Circular.

Brown Hair Dye.—(J. W. D.) Hager gives the following formula:

Silver nitrate	30 grammes.
Copper sulphate, crystals	20 "
Citric acid	20 "
Distilled water	950 "
Ammonia water, q. s. to dissolve the precipitate first formed	

Various shades of brown may be produced by properly diluting the solution before it be applied.

Another "one bottle" preparation is this one:

Pyrogallic acid	4 drams.
Sodium sulphite	30 grains.
Alcohol	1 ounce.
Water	3 ounces.

Dissolve the acid in the alcohol, the sodium sulphite in the water, and mix.—Pharmaceutical Era.

AN OFFICIAL INK.

THE State of Massachusetts has an official ink for public records. A law providing for such an ink was passed four years ago upon the suggestion of the secretary of the commonwealth and the commissioner of records. They found that many of the public records were fading, among them the original manuscript of the State Constitution adopted in 1780. Earlier records, including the original charter of the colony, which is 152 years older than the Constitution, are mostly in a good state of legibility. It would appear that the colonial authorities gave attention to the matter of imperishable ink, undoubtedly using a fluid long tested in Great Britain.

With the freedom of the colonies came a certain carelessness, as many colors and varying permanence are apparent in later documents. Up to 1850 most of the ink was good. From that time the ink varied greatly, and a good part of it was poor, so public documents are fading out. Copies of the early records of Lexington deposited with the secretary of the commonwealth have become almost illegible.

The act passed four years ago made the secretary, as chief recording officer, responsible for the ink to be used for records in the commonwealth, and he took steps to find a suitable fluid for the purpose. The tests employed are described as follows by The Boston Globe, from an interview with the secretary:

"The acceptable ink had to be able to withstand the action of the sun's rays behind a glass covering for three months.

"Then it was decided that a severer test than that should be applied.

"The ink had to withstand for three months not only the action of the sun shining through glass, but to withstand for six months, without any protection whatever, the action of the elements.

"And before this test was applied the paper containing the ink had been soaked in water, and then in alcohol and then in alcohol and water, to determine whether the color would fade or spread.

"Strange as it may seem, an ink was found that would withstand all these tests. It could be scorched by the heat and wet by the rain for six months, and also subjected all that time to every change of atmospheric temperature, and it would still be unchanged in strength and color on the paper."

An ink that met these requirements was purchased and supplied at a fair price to the record officers of the State. Last year the purchases amounted to about \$1,000. The formula of the ink was a requisite of the contract with the makers, and the secretary publishes it as follows:

"Take of pure, dry tannic acid, 23·4 parts by weight.
"Of crystal gallic acid, 7·7 parts.
"Of ferrous sulphate, 30·0 parts.
"Of gum arabic, 10·0 parts.
"Of diluted hydrochloric acid, 25·0 parts.
"Of carbolic acid, 1·0 part.
"Of water, sufficient to make up the mixture at the temperature of 60° F. to the volume of 1,000 parts by weight of water."

The secretary would use a better ink if he could get it, and is still receiving samples for tests. It would be interesting to learn if attention has been given to the permanence of records in the State of New York. In the absence of information we presume that the secretaries of state have attended to this matter through all the years from colonial times. The legislature would do well to ascertain the facts, so a change may be inaugurated in case any carelessness is evident.

Town and county records are undoubtedly in bad condition. Provisions for keeping town records is not, as a rule, adequate, and the records are moved hither and thither as the incumbents of the office of town clerk are changed. Under these conditions it is not to be expected that much care will be taken in selecting durable ink or paper.

The paper now in use is a matter of greater concern than the ink. During the last session of Congress the question of suitable and enduring paper for public records and official publications was taken up, but we believe that no definite action was taken. It is highly important that States, counties and towns attend carefully to the selection of ink and paper for public records. The value of records will increase as the years go by. As a nation, we are yet young, and care should be taken now to avoid the confusion and loss that will inevitably ensue from fading records, or those that fall apart because the paper was intended only for immediate use. Our county authorities should look to this matter immediately if it has been in the least neglected.—Rochester Democrat and Chronicle.

SLEEPLESSNESS.

INABILITY to sleep is merely a symptom, though of extremely varied origin. It may, however, be of such serious import as to require especial consideration and treatment. The first indication naturally is always to determine the cause, but this is sometimes obscure. In the failure to do so symptomatic measures may, for a time at least, be required. The subject of sleeplessness as constituting the especial complaint for which the patient seeks advice is discussed in an interesting manner by Broadbent (Lancet, January 27, 1900, p. 215) in a recent clinical lecture. Opiates or sedatives may be employed when the brain has been overtaxed by engrossing work, or the nervous system has been upset by a profound shock or exhausted by overwhelming anxiety or by excitement, or the habit of sleep has been interrupted by long and anxious vigils over a sick-bed.

Fresh air and exercise are among the most important influences that tend to bring the nervous system into a state favoring sound and refreshing sleep. In some persons sleep is disturbed by exceedingly slight influences, such as a change of bed, the faintest noise, the presence of light, and the like. If restlessness be present also, chloral may be employed when the pulse exhibits high tension, and paraldehyde or bromides, or morphine and hyoscyamus, when the tension of the pulse is low.

Sleep may be prevented by coldness of the feet, and relief may be afforded by hot bottles or by enveloping the parts in warm flannel. A little hot and strong beef tea or hot milk on going to bed will favor sleep when the circulation is sluggish. Sometimes vigorous local

friction may be required, possibly given after making the patent stand in cold water.

Sleeplessness may, on the other hand, be due to a sense of heat and burning in the feet, the patient being awakened rather than prevented from going to sleep. There may be actual objective heat, as well as the subjective sensation. The condition is sometimes associated with gout, rheumatism, or deforming arthritis, or other local disorder to which treatment should be directed.

Defective elimination of the products of proteid metabolism may cause high arterial tension and sleeplessness, and the indication then is to regulate the diet and stimulate excretion. Mercurials and salines, and drugs of this class, are useful in this connection. Low arterial tension also may interfere with sleep in the recumbent posture, although the patient may be unduly drowsy in the erect position. Tonic treatment will then be required.

Indigestion in its various forms is considered a most common cause of sleeplessness, and flatulence, especially gaseous distention of the stomach, is looked upon as one of the most active factors. In addition to treatment of the fundamental conditions, a glass of hot water at bedtime may be effectual in preventing interference with sleep. Should this not be sufficient, it may be preceded by aromatic spirit of ammonia and sodium carbonate, or an alkaline carminative draught may be given. Sodium carbonate or sulpho-carbolate with aromatic spirit of ammonia, compound tincture of cardamon, or ether and peppermint water or camphor water, and sometimes sodium bromide or ammonium bromide, may be added with advantage for a time. Friction over the abdomen or between the shoulders may aid in dissipating flatulence. This treatment should, however, not be persisted in longer than necessary. When tea or coffee gives rise to sleeplessness, its use should of course be abandoned.

For the sleeplessness accompanying or following influenza, opium or morphine with hyoscyamus or atropine may be required, should tonics such as arsenic, phosphorus, strychnine, and quinine fail to bring relief. Sleeplessness due to alcoholic excess requires, in addition to withdrawal of the stimulant, the administration of strychnine or nux vomica in considerable doses.—Medical Record.

THE AUTOMOBILE AS SEEN BY THE CARICATURIST.

The possibilities of the bicycle have been so completely exhausted in the comic weeklies, that the caricaturist has gladly enough entered the new field opened by the introduction of the automobile. From the numerous pictures which have appeared of late it would seem that the comic artist finds the automobile a subject even more prolific than the bicycle. As an example of the pictorial jokes which find a place in European papers, we have reproduced from the Illustrirte Welt, a German caricaturist's idea of the possibilities of the automobile.

THE AUTOMOBILE IN PEACE AND WAR.

POWER CONSUMPTION AND OPERATIVE COSTS OF AUTOMBILE DELIVERY WAGONS.

By Prof. George F. Sever.

The purpose of this article is to present a brief resume of the data and results obtained in the early part of 1899 while investigating the operative costs of electric and horse delivery service in New York city.

In the paper on "Operating Costs of Horse and Electric Delivery Wagons in New York City," by R. A. Fliess and the writer, presented at the general meeting of the American Institute of Electrical Engineers, at Boston, in June, 1899, a very careful analysis was given of the actual costs of operation of the two methods of service under city conditions. Up to that time, says The Electrical Review, there was available little information of an authoritative nature on the cost of horse operation and, therefore, this information obtained from business houses with large delivery services provided a basis of comparison which is valuable. More recent figures obtained from other business houses using horse service corroborate the data on this service, so that we can accept these figures as a recognized standard.

From the data on horse operation the cost of maintaining such service was found to be as follows: Total cost of 1 wagon, 1 horse, wages and attendance per day equals 364·83 cents, of which 64·61 cents or 17·7 per cent. is chargeable to the horse, 14·52 cents, or 3·98 cents is chargeable to the wagon, and 285·7 cents or 78·32 per cent. is required for the wages of the driver and his helper.

The total weight to be moved is 2,075 pounds or approximately one ton, 500 pounds of this being considered the weight of the load to be delivered. In this service each wagon covers 21 miles per day, so that the cost per ton-mile, which is the unit of comparison, would be 364·83 ÷ 21 = 17·373 cents.

In the case of a wagon covering twice the distance of the first, i. e., 42 miles per day, there will be needed two horses and, therefore, an additional expence for those items as is shown by the following figures: Total cost of 1 wagon, 9 horses, wages and attendance per day equals 428·54 cents, of which 128·32 cents or 29·9 per cent. is chargeable to the horse, 14·52 cents or 3·3 per cent. is chargeable to the wagon, and 285.70 cents or 66·8 per cent. is chargeable to the wages of the driver and his helper. The cost per ton-mile will be 428·54 ÷ 52 = 10·2 cents in considering the cost per pound of load per mile; under these two conditions we find that, in the first instance, with a total load of 800 pounds and an average of 500 pounds, this cost is 364·83 ÷ 800 = 0·456 cents per pound and 364·83 ÷ (500 × 21) = 0·0347 cents per pound per mile.

In the second case with more load delivered, a longer distance covered and requiring more equipment, we find the cost per pound with three loads of 800 pounds delivered, 428·54 ÷ 2,400 = 0·17856 cents, and the cost per pound per mile with an average load per trip of 500 pounds, 428·54 ÷ (500 × 42) = 0·0204 cents.

The conclusion is readily deducted that the latter method of operation is the more economical although involving a larger first cost for equipment. In the second case the wagon is used nearly three times as much as in the first and the employees are used to better advantage, thereby tending to more economical operation.

The tests on the electric automobiles were made for the purpose of ascertaining the actual power required to operate them on the various pavements which exist in New York city streets, the vehicles used for this purpose being those which were to be used in delivery service. The opportunity presented itself to test vehicles of different design and widely differing characteristics, so that from the results could be obtained a general and quite accurate figure for the power consumption necessary for this service. From these tests the power required is found to be 120 watt-hours per ton-mile or 0·156 horse-power-hours per ton-mile.

This value for the power consumption has been borne out by subsequent tests and can be considered a reliable value to use in estimating the average power necessary for operation. It must be remembered, however, that a larger capacity than that which is necessary to provide this 120 watt-hours per ton-mile, is imperatively required to start the vehicle or propel it up a grade. The power to give a rapid start may be from four to six times that which is necessary for operation at a constant speed on a level or that value which represents the average of a run.

The minimum power used in any of the tests made was 81 watt-hours per ton-mile, showing that with careful manipulation and taking advantage of the features of the roadway, the power used may be reduced considerably from the general value of 120 watt-hours per ton-mile.

In order to ascertain the difference between the cost of delivery with horse and that with electric vehicles, the following comparison can be made: An electric wagon at an average speed of nine miles per hour would cover the same distance per day, i. e., 42 miles, as made by the horse wagon in 4·66 hours and the cost for power at 5 cents per kilowatt hour, with a power consumption of 120 watt-hours per ton-mile, would be 71·28 cents. The weight of the wagon complete, with average load of 500 pounds, is 2·263 tons. In this case the cost of power, 71·28 cents, forms 17·6 per cent. of the total operating cost, interest on wagon and stable rent, 47·28 cents, forms 11·7 per cent., and wages for driver and helper, 285·70 cents, form 70·7 per cent., the total cost for operating 42 miles being 404·26 cents. As compared with the cost of horse service, there is seen to be a saving of 428·54 − 404·26 = 24·28 cents per day under the above conditions. The cost per pound of delivery is 0·16844 cents against 0·17816 for the horse, or 0·01012 cents less. The cost per ton-mile is 4·25 cents against 10·2 cents for the horse, or a saving of 5·95 cents.

The figure is of importance for the reason that the ratio of load to be delivered to total weight of wagon is small and every effort should be made to reduce the weight of the wagon in order to reduce the total power cost. If the figures are analyzed somewhat differently from the method indicated above, leaving out the fixed wages for driver and helper in both cases, it is found that the cost of the horse forms 90 per cent. of the operating costs in that service, while the cost of power in the electric service is only 60 per cent. The actual cost of operation then becomes 142·84 cents per day for horse and 118·56 cents for electric, showing as before 24·28 cents per day saving in the latter, this being a 17 per cent. saving over horse operation. This is unquestionably a more correct method of comparison in the matter of power cost, as the fixed charges are eliminated. At present it is not possible to present any depreciation values, for the reason that the apparatus is too new to afford any. In the electric service these depreciation values should not be large, as the motors and running parts are simple and require but little attention. The battery possesses the largest depreciation factor, it being possibly 20 per cent.

In comparing the cost per pound of load per mile it is found that with horse service this is 0·0204 cents and with electric 0·01923 cents, or a saving of 0·0015 cents.

That the differences shown are not larger is due to the fact that in making the comparisons, the lowest average cost for horse service has been taken and the highest cost for electric service has been placed against this. With cheaper power a further reduction can readily be made in the operative costs and a better showing made for the electric service. It can be pointed out that if the schedule speed of the automobiles can be raised, the wagons can cover much more territory per day, and, therefore, reduce the percentage that the employees' wages are of the total. This is a similar condition to that which exists in electric railway operation and many of the same operative details that now control railway work can be successfully applied to electric delivery service. As has been hinted at previously, the

attempt should be made to reduce the weight of the automobile for this service, in order that the live load may more readily approach the dead load, thereby decreasing the power cost.

THE BUDAPEST ACETYLENE EXPOSITION.

LIGHTING by acetylene has now reached a stage where it commands expositions of its own, much as was the case with electricity in the earlier phases of its application to lighting, and the second of these expositions was held in the latter part of last year at Budapest. A general review of the exhibits there shown forms the subject of a paper by Herr Karl Neudeck, in the Zeitschrift des Oesterr, Ingenieur und Architekten Vereines, the author being the delegate of the society to the exhibition, and this report forms an excellent view of the present status of the subject at the present time.

The use of acetylene gas involves three distinct elements: the carbide, the generator, and the burners. Although the manufacture of carbide is impracticable as an exhibit, owing to the fact that commercial reasons demand the employment of large installations, driven by water-power, yet the material itself is an important subject for discussion, especially as regards its purity, most of the impurities which require additions to the generator for their removal from the gas, having their origin in imperfections in the method or material in manufacture. The presence of phosphorus or sulphur in the raw materials causes the formation of phosphureted or sulphureted hydrogen in the generator, while ammonia and other objectionable compounds are produced if impure carbide is employed. Purifiers are, therefore, generally necessary, but these may be considered as forming a portion of the generating apparatus.

Generators may be divided into two classes, the object of both being to effect a controlled combination of carbide and water. In one class a small quantity of water is fed to a large quantity of carbide, and in the other a small quantity of carbide is added to a large quantity of water. The first method permits generators of simple design, but it has a number of operative drawbacks, such as the generation of much heat, the clogging of taps and pipes, the inability to check generation of gas promptly, or to effect complete decomposition of the carbide, yet a number of practical generators upon this system have been made, and were exhibited at Budapest, but most of these were for small installations.

The second class, in which the carbide is fed into a comparatively large quantity of water, avoids any objectionable elevation of temperature, the gas being cooled by bubbling up through the water, and most of the ammonia and sulphureted hydrogen being absorbed. The complete immersion also insures the total decomposition of the carbide, and the only practical difficulty experienced in this class is that of regulating automatically the feeding of the carbide.

Both classes of generators were represented at the exposition, as well as a variety of burners, and also a few motors intended to be operated by acetylene instead of ordinary coal gas.

These various exhibits are illustrated and described in detail in Herr Neudeck's report, which is too voluminous to be reviewed except in a general way. As already stated, the dropping of water upon the carbide, the earliest system employed, was used in but few of the smaller generators exhibited, but the modifications of it in which the water rising or falling comes into or out of contact with carbide in a cage or open holder, appeared in several instances, the mechanical simplicity of regulation possible by this method evidently appealing to the designers.

Of more interest are the generators based upon the principle of feeding the carbide directly into a comparatively large body of water, decomposing it immediately and completely into the full quantity of gas possible; and the machines of this type exhibited were numerous, and many of them ingenious. For small plants the carbide may be fed in by hand, a few lumps sufficing to deliver into a suitable holder enough acetylene to supply several burners for an evening; but for regular service, such as in hotels, warehouses, and similar situations some automatic feed is desirable. This automatic feed is generally accomplished by the rise and fall of the gas holder, some form of rachet mechanism acting to drop a charge of carbide into the generator when the bell of the holder has reached its lowest position. Attempts to feed the carbide in through a funnel and feed-wheel have not been generally successful, there being a tendency to clog unless the carbide is crushed, and in the later machines the plan of having the carbide placed in a number of compartments, successively opened as the demands for it require, seems to be the favorite most of the machines exhibited being of this type.

In the important department of burners there does not seen to have been much progress made, most of the exhibits being of the form employing two jets, impinging upon each other to form a flat flame at sufficient distance from the aperture to prevent the clogging due to overheating, so objectionable in the early forms of burners. The tips of the burners are still generally made of steatite, and in some cases shields are used to protect the capillary openings from the obstructing deposit which forms from the polymerization of the acetylene by heat. Burners of the Bunsen type, in which air is mingled with the acetylene just before combustion, seem to have dropped out altogether, as none was exhibited, and the important field of mixed acetylene and oil gas, so successfully used in Germany for car lighting, was not shown, although this is the one application of acetylene which appears to have been established upon a commercial basis.

Reference has been made to the purification of acetylene, and among the methods employed at the exposition may be mentioned that of Wolff, using chloride of lime, and those of Frank and of Ullman; the former using an acid solution of copper salts, and the latter chromic acid.

Judging from the results of the use of acetylene in motors at the exposition it is still too expensive to be employed as a source of motive power. The engine tested used 500 to 700 liters of illuminating gas per horse-power-hour, and 180 to 220 liters of acetylene, but the higher cost of the latter brought the cost of a horse power hour up to 3·5 to 4·9 kreutzers for gas, and 15 to 18 kreutzers for acetylene, although the latter might occasionally find employment when a greater power was desired in a given space and weight, regardless of cost.—Engineering Magazine.

NORWEGIAN SKEE JUMPING AND RACING.

THE great winter festival at Christiania is Holmenkollen Day—the day of jumping and racing upon "skees," or long wooden snowshoes curved at their front extremity.

We shall endeavor to give as accurate an idea as possible of the sport above mentioned, which is scarcely known outside of Norway.

In the first place a steep hill is selected having at its foot a lake which, at this season, is entirely frozen over and covered with snow. At about the center of the declivity is fixed a wide spring-board, which is covered with a thick layer of snow and is surrounded by bunting representing the national colors of Norway. The jumpers stand in a crowd upon the summit, and at a given signal, one of them makes a flying start, quickly

A RACE UPON "SKEES" IN NORWAY.

covers the space that separates him from the board, and from the extremity of the latter, makes a jump and lands at a distance which, when the snow is favorable, sometimes reaches nearly a hundred feet. Then, carried along by the momentum that he has acquired, he descends the rest of the slope with the speed of an express train and stops at the extremity of the lake in a graceful curve amid the applause of the multitude and to the strains of military music.

Although falls are frequent, hardly any accident ever occurs except the breakage of a pair of skees.

At the last competitions at Christiania the snow was too recent and had not acquired sufficient compactness, and so the jumpers could not slide with the facility desirable. Many fell and disappeared completely under the snow and reached the bottom of the hill by rolling like a ball. No one was injured. At the end of the day, jumping was done in groups of two and three, the jumpers holding each other by the hand.

It may be easily seen that such sport as this requires muscular energy, coolness and intrepidity. It is, however, a passion with the majority of Norwegian men and women.

On the last occasion, the jumps were not as fine as they have sometimes been. The greatest distance reached was 75·5 feet, and the mean distance 59. This was not very bad, however. Our engraving represents a race upon skees, which took place upon the same occasion. For the foregoing particulars and the engraving, we are indebted to Le Monde Illustré.

EDUCATIONAL VALUES.*

HISTORY is always an attractive subject because it appeals to our sympathies. There is not one of us who has not been spurred to effort by the hope of reward, intellectual, moral, social, or material. Everyone has at times enjoyed the consciousness of success, or suffered the sting of failure. The history of the race is the collective history of individuals. Every individual can in imagination put himself into the place of the actors who have left strong impressions on the world and been enrolled among the makers of history.

The history of education appeals less strongly to our feelings than does the recital of deeds that determined or destroyed men's leadership in the control of their fellows. But all of us have a very real interest in some of the educational problems of the day. From some points of view it is fortunate, from others, unfortunate, that the consideration of these problems implies conflict. We have all heard about a conflict, which is said to be very sanguinary, between the advocates of scientific study and those of liberal culture. I must confess that in my earliest manhood I rushed into this affray with all the joy an enthusiasm and self-confidence that a young man feels when he knows that he must be inflicting hard blows upon the adversary, even if the adversary does not think them very hard. I had spent several years in mastering a certain amount of Latin, Greek, mathematics, and a few other subjects of supposed minor importance. In regard to educational values, my opinions were soon very decided, and the decision was by no means in favor of the curriculum through which I had been guided by my respected, but mistaken friends, the professors. It is a familiar saying that "history repeats itself." Having stepped some years ago out of the young man's shoes into those of the professor, I am now at liberty to wonder how many students will go forth from this institution next summer, ready to prove that not only I

* An Address before the student body of Washington and Lee University, February 14, 1900, and published in Science.

myself, but all of my esteemed friends, my colleagues in this faculty, are old fogies.

The world cannot get along without young men. Perhaps it could, but it does not, get along without the old fogies.

We have all heard of the man who was born tired. I have actually seen a good many men who were born old fogies, and who became superannuated before reaching middle age. I have seen others who had passed their three score years and ten without losing their passion for progress, the willingness to take in new ideas, the intellectual alertness of their youth. But certain it is that most of us need contact with young men to keep us from becoming too self-satisfied. The college professor has other duties besides pouring out knowledge and testing his students by written examinations. He must be tested by them; he must let them see that the reciprocity is not all on one side. As soon as he begins to think that he has nothing to learn from them, it becomes the proper time for him to step aside. They are his teachers so long as he retains the capacity to learn. They may make mistakes, but so does he. They are generally disposed to be progressive, if their independence has not been stifled by too great success in acquiring the habit of depending upon authority.

If there is any one characteristic by which the scientific education of to-day is conspicuously in contrast with the so-called liberal education of two generations ago, it is found in the modern inculcation of the duty to be independent and manly, to use authorities as means and not as ends, and to accept no authority whatever as beyond question.

Let us go back for a moment then into ancient history and inquire into the origin of the worship which some of us were taught to offer to the fair goddess of liberal culture, the worship of a name while the actual culture was anything but liberal. It is not my wish to criticise our own conditions here, for, happily, the Washington and Lee University of to-day is so different from the Washington College of our grandfathers that they would find themselves much puzzled, perhaps even shocked, if they could step forth from their graves and visit us. The idea with which they were saturated was that the chief end of all education was discipline, and that a certain small number of subjects were inherently better for discipline than all else that related to human interests.

If a young man were drilled until he could memorize a Greek play, a Latin oration, and a chapter of calculus, he was conventionally the possessor of liberal culture. The allowance was, as we now believe, very illiberal; but it was all that he could get. There were three liberal professions, divinity, law, and medicine, one of which he must select, but not one of which involved any special application of what he had studied in college. Vicarious discipline was, therefore, the sacred means by which he was to attain his earthly salvation.

Such an idea of education was accepted quite generally and cheerfully, because it was traditional and, therefore, respectable. It had been usual not only during the previous generation but during a hundred generations.

Among the ancient Greeks the body was educated by gymnastic exercises, but this was confined chiefly to the aristocracy; for useful labor, involving bodily exercise, and hence muscular development, was looked upon as menial and degrading. Intellectual education was regarded from the same standpoint. It might be a badge of gentility, but to seek useful knowlege was no more an educational object than to learn useful arts. Intellectual gymnastics for its own sake was a source of pleasure. To regard it as a source of profit would be to degrade it. "Not the game, but the excitement of the chase; not the truth, but the exhilaration of its pursuit, were the mottoes of culture. Under these circumstances no vulgar question of economy could arise; mental power was ostentatiously wasted, and with the necessary consequences—truth unsought was not found; the ends of culture being ignored, there was neither conquest of nature nor progress of society."

Such ideals have continued potent to the present day. In medieval times they were cultivated in the monasteries. It was for the support of them that universities gradually became organized. They are still dominant at Oxford and Cambridge, in England, and in the universities of Germany, France, and Italy. Their great value is readily conceded. If they constituted all that could be included in modern education, they would still be worth preserving and fostering. Under such ideals were educated some of the greatest men whose labors have advanced physical science, such as Newton, Huyghens, and Laplace. The craving of humanity for intellectual exercise without reference to bread winning is as natural as the craving for food, or bodily activity, or companionship, the love of home, of family, or of country. The love of literature, of art, of science for its own sake, is conspicuously worthy of all commendation and encouragement. To know the best that has been thought and spoken and written, to appreciate the noblest and purest that the painter's brush has left upon canvas, to be capable of taking in the ideas and complex emotions that are conveyed in song and symphony, to apprehend the order and harmony that pervades a universe that is continually undergoing evolution in accordance with law—these are objects well worthy of our best efforts, irrespective of the remuneration that can be expressed in money or material power.

But the culture so eminently worthy of our seeking is not all that the world is justified in holding to be valuable. Why should such training be given in youth? It is not merely because the young are non-producers in society, but because they are more capable of modification than after maturity is reached. That the education to be given in youth should be a preparation for manhood is an idea that does not seem to have been well grasped by the educators in ancient or even comparatively recent times. Education was long reserved for the priesthood, rather than for the manhood of the people. Its underlying idea was the preservation of scholastic authority rather than the development of intellectual independence and moral power. It was intended to be a luxury for the few, while the masses were expected to keep on toiling in ignorance as had been done throughout untold centuries. The education of the English universities, even of this year 1900, is essentially aristocratic. Great stress is laid upon certain subjects, not because they afford the best culture, but because they are traditionally genteel, not because they confer power, but because they have long been fostered by the nobility. Even the army, officered by aristocrats who substituted gentility for military knowledge, has been this winter betraying its organic weakness in South Africa, and the liberally educated English have yet (February 14, 1900) to herald their first victory over the despised Boers, after four months of disastrous grappling. They will in time be victorious, but not by the application of what they have been taught through genteel traditions.

The educational system of a country should be adjusted to the needs of the majority of its people, and not be controlled by the nobility, whether this term be applied to the aristocracy of inherited rank, as in England, or of wealth, as in America. As soon as the question of educational values arises, therefore, we must ask ourselves, with candor and with utter disregard of genteel traditions, what kinds of knowledge are best fitted to develop mental, moral, and material power in our young men, recognizing the conditions of civilization as they exist to-day in the most prosperous parts of America. We are not to decry liberal culture; but we are abundantly justified in criticising the traditional limitations which have restricted the name of liberal culture quite arbitrarily to a certain group of studies. What is the ground upon which these studies have been called liberal? It is that they are now, and have long been, genteel; that they do not aim to help their votaries to make money; that their object is to produce such intellectual and social polish as money can not buy; that the stored up capital which they represent must not yield interest in money, but only in culture; it must be totally independent of all commercial values.

This ideal was almost completely fulfilled during the many centuries of its dominance up to the nineteenth century. But commerce is stronger than an ideal. Is literary culture to-day without its pecuniary rewards? Is fine art practiced purely for purpose of expressing the beautiful? So far as activity is expended for the cultivation of the true, the beautiful, and the good, the culture is liberal. So soon as the results of such activity cease to be given freely to the world, and become devoted to the acquisition of money, the name liberal ceases to be applicable. There are hundreds of men and women whose interests in college were concentrated upon literature, classics, and history, and who apply the results of the mental discipline thus acquired, and the knowledge thus stored up, directly to the money-making business of writing novels. There are thousands more who are well paid for contributing to the newspapers such fiction as is euphemistically called news. All of it is called literary work, and the writers receive the credit of dwelling in an atmosphere of liberal culture. Fortunes have been made by judicious response to the popular demand for light literature, and the liberal culture disseminated is directly proportional to the liberal payment laid down in silver and gold. On the other hand, there is an increasing number of young men who annually come forth from American universities, and yet more from German universities, whose time has been devoted to studies that by contrast are called scientific. They spend time and labor in the pursuit of science for its own sake. The results of their investigations are published in journals for which the general public has no use; and they receive no compensation for such contributions except the satisfaction of making themselves and their work known to the so-called scientific world. Their inquiries relate to subjects which have no commercial importance, and their object is, without pay, to enlarge the boundaries of human knowledge. Their stimulus is the pleasure of discovery, of investigation, of successful intellectual activity. The recognition they receive is such as money cannot possibly buy.

Nor have these scientific investigators been confined to the present century. Newton's Principia marked an epoch in science. It brought no money to its author, though succeeding generations have built upon it the remunerative science of navigation. Huyghens, Young, and Fresnel established the wave theory of light, the foundation of the now useful science of optics. They gave the products of their labor freely to the world, living economically, and dying with very small possessions. Gauss and Weber established the modern science of magnetism, while Volta, Oerstedt, Ampère, Ohm, Faraday, Henry, and Maxwell worked together and in succession to make electricity an exact science. They received no pecuniary rewards, but we to-day are reaping the fruits of their labors in the electrical industries that afford employment to a million of men and absorb hundreds of millions of capital. Shall we declare that these original investigators, these men of genius, were not representatives of liberal culture, merely because the subjects upon which their brain power was expended happened not to relate to literature, or linguistics, or art, or history? Some of these much decried scientific men, such as Tyndall, Huxley, and Darwin, proved themselves to be adepts in the art of writing clear and forcible English. Were they devoid of culture? Tyndall knew little of Latin and nothing of Greek, but in the battle where tradition was arrayed against truth he displayed such culture and such vigor as to make him a match for more than one classically educated bishop.

The attempt to establish a line of division between science and liberal culture is an anachronism. We have outgrown the authority of our fathers who accepted the exclusive gentility of a certain group of studies and shrugged their shoulders at the young parvenu whom they called science. Let me here express my sympathy with the protest directed against the abuse of this comprehensive word, science. If the meaning of a word is determined by etymology, science merely means knowledge. It makes no difference whether the subject be chemistry, physics, economics, or philosophy; if the knowledge be definite, consistent and organized, it is science. If it be vague, if mere fancy is accepted as a substitute for fact, if dogma is balanced against demonstration, it is not science, it is not knowledge, though it may be brilliant imagination. But the meanings popularly attached to words are not determined by etymology. Whether rightly or wrongly, the word science has become restricted by tacit popular agreement to our knowledge of things in contrast with our knowledge of words or our speculations about ideals. When we appeal to nature, our conclusions need verification before final acceptance. Those methods of investigation which imply verification are conventionally called scientific. If they become successfully applied to any subject whatever, the knowledge thus acquired becomes scientific.

Thanks to the scientific spirit that has leavened all modern institutions of learning, the scientific method is now increasingly applied to subjects which were formerly bound down by the shackles of tradition. It has raised to a high and dignified level subjects which were not recognized a generation ago as having any place in a liberal education. Prominent among these new sciences, these new elements of liberal culture, are political science and economics, equal in importance with physics and chemistry, even if they do not call for laboratory work. These new sister sciences may not be so traditionally genteel as the prim old sisters called classics and mathematics, but they are fresh, smiling, and apparently quite irresistible.

The extent to which the old and traditional culture studies are giving place to modern and equally liberal culture studies is well shown by reference to last year's statistics at Yale University, an institution which was long one of the strongholds of conservatism. In all the higher educational institutions of the present day more or less liberty is accorded the student to elect at least some of the studies to which his time is to be devoted. The most popular subject at Yale last year was political economy, which was elected by 957 students: history was elected by 822, English by 529, philosophy by 398, modern languages by 266, classics, including both Latin and Greek, by 172, and mathematics by 37. Under the head of natural science, including astronomy, physics, chemistry, geology, and biology, the number of elections was 257. This certainly does not look as if the representatives of science, using this term in its conventional sense, are in a position to smile, either contemptuously or patronizingly, upon the devotees to so-called liberal culture.

The object of education is to make each one of us as nearly perfect a human being as he is capable of becoming. The great majority of those who begin to receive an education are restricted to elementary work. The determination of educational values depends in every case upon individual needs. Good mental discipline can be acquired by the systematic and earnest study of any subject whatever if the student has a living conviction of its importance, and the teacher has brains, enthusiasm, and skill. Any subject may be made a means of liberal culture if both teacher and student are stimulated by the love of knowledge. The law school, the medical school, the technological school are as necessary for the higher grades of professional culture as the college is for general culture. The student is not harmed but healthfully stimulated by his recognition of the vital importance to himself of what is drawing forth his best efforts. Let us welcome every new opportunity that is given our young men to adapt themselves to the requirements of modern life. No amount of declamation or invective can displace physical science from its present high position. Those of us who are devoted to science are willing and glad to clasp hands with all who are ready to go with us onward and upward.

No classification of educational values has been given that is superior to that that was expressed about forty years ago by one of the greatest of modern thinkers, Herbert Spencer. In the order of their relative importance the leading kinds of activity which constitute human life are grouped as follows:

1. Those which directly minister to self-preservation.
2. Those which, by securing the necessaries of life, indirectly minister to self-preservation.
3. Those which have for their object the rearing and training of the young.
4. Those which are involved in the maintenance of proper social and political relations.
5. Those which make up the leisure part of life, devoted to the gratification of the tastes and feelings.

The best education is the best preparation for all of these activities, its aim being to maintain a due proportion between the degrees of preparation in each. The order of relative importance is obviously the inverse of the order of diversity and complexity. It is not surprising, therefore, that up to a very recent time the work of educators has been confined chiefly to the last one of the groups of activities enumerated by Spencer. But in spite of educational traditions the world has lately been demanding attention to the other groups, and modern science, as taught in our foremost universities and technical schools, is the response to that demand. Mr. Spencer considers the educational needs implied for the best exercise of all these activities; and in answer to the question—What knowledge is most worth?—the answer is Science.

"For direct self-preservation, or the maintenance of life and health, the all-important knowledge is —science. For that indirect self-preservation which we call gaining a livelihood, the knowledge of greatest value is—science. For the due discharge of parental functions, the proper guidance is to be found only in— science. For that interpretation of national life, past and present, without which the citizen cannot rightly regulate his conduct, the indispensable key is—science" —economics and political science. "For the most perfect production and highest enjoyment of art in all its forms the needful preparation is still—science. And for purposes of discipline, intellectual, moral, religious, the most efficient study is still—science."

It is not to be expected that these conclusions will be accepted by all to whom they are addressed. I should be the last to decry the importance of language study, of history, art, and philosophy. I emphatically emphasize the importance of national education in economics and political science. We are sadly in need of better political teachers than a majority of those who during the last few years have been the leaders in American politics. But I protest against the implication that liberal culture is suffering at the hands of either the active workers or the leading teachers in science. So long as human needs and human tastes are diversified, must there be corresponding diversity in education? Let each of us recognize what is good in our neighbor; let us cheerfully and cordially acknowledge the value of his contribution to human welfare; let us remember that there are others besides scientific men who are progressive, and that the boundaries of knowledge are without limit.

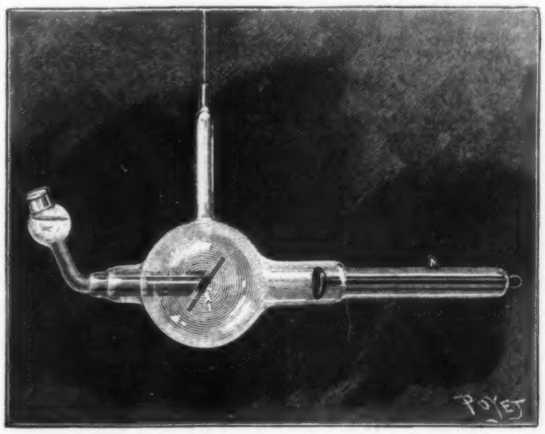
Within the present century one of the greatest mathematicians and astronomers that the world has ever known, Laplace, lay on his dying bed in Paris. His last words were: "Ce que nous savons est peu de choses; ce que nous ignorons est immense." It takes a philosopher to recognize the immensity of his own ignorance. If Laplace could use those words as he fell asleep, why can we not at least follow him and remain at peace with each other while striving to do our share in increasing human knowledge? Linguist and engineer, historian and chemist, economist and physicist, metaphysician and mathematician, our aims radiate from a common center; but friendly and faithful as we may be to each other, our ignorance will still continue to be immense. W. LE CONTE STEVENS.

A NEW RADIOGRAPHIC BULB.

RADIOGRAPHIC bulbs have the great drawback of rapidly heating at the cathodic center; and so, when it is necessary to expand great power in the apparatus, the duration of activity becomes limited. Numerous researches have been made with a view to devising a method of cooling the platinum anticathode, or target that deflects the rays; but none of them has given successful results.

MM. Abel Buguet and Victor Chabaud have recently presented to the Academy of Sciences a new type of bulb with a water-cooled anticathode, which is illustrated in the accompanying figure. This bulb is provided with an anticathode formed of a large platinum tube soldered directly to the glass of the bulb. The tube is enclosed as far as the center of the bulb by a glass sleeve that protects it from the inverse induction of the Ruhmkoff coil. It is beveled off at its internal extremity, and the platinum deflector soldered thereto closes it hermetically. A small reservoir of water is connected with the external extremity of the platinum tube. In case it were preferred to make use of circulating water or mercury, all that is necessary is to replace the reservoir of water by an arrangement of two concentric tubes connected with the free extremity of the platinum tube by means of a rubber stopper. The smaller of these two tubes extend through the platinum tube nearly to its inner end.

In operation, the cathodic rays fall upon the obturating platinum plate. As this latter is, through its posterior surface, in immediate contact with the water, it is impossible for it to reach a temperature higher than that of the free ebullition of the liquid.



MM. BUGUET AND CHABAUD'S RADIOGRAPHIC BULB.

The apparatus is capable of receiving discharges from the most powerful coils, actuated by the most rapid interrupters, without the anticathode reddening, even though the coils were capable of melting an ordinary anticathode in a few seconds. The state of vacuity of the tube undergoes no modification during the operation of the apparatus.

It is possible to obtain and maintain the highest power of X-rays, while the pencil of radiations preserves the composition that is best adapted for each particular application of radiography or radioscopy. For the above particulars and the engraving, we are indebted to La Nature.

ONE HUNDRED YEARS OF ACHIEVEMENT IN AMERICAN GLASS MANUFACTURE.

By C. A. TATUM.

THE art of glass making antedates the appearance of man on earth, having been practiced by Mother Nature herself in that wonderful laboratory that is enclosed in the everlasting hills. It may very truthfully be said that man used glass before he made glass. We find arrowheads and knife blades of obsidian or volcanic glass which might very well have been used by the cave dwellers in the days before the art of glass making had begun to wield a potent influence upon the civilization of Babylon and Egypt and Rome.

EARLY HISTORY.

It has come down to us from Pliny, who covered too wide a field of knowledge to be always reliable, that the discovery of the manufacture of glass was due to substituting cakes of niter for stones as supports for cooking pots. He has it that there once landed upon the coast of Palestine a party of Phœnician merchants, who, finding no stones on which to rest the pots in which they cooked their food, resorted to cakes of niter from their cargo, which they substituted for stones as supports for their pots. The heat of the fire, blending and melting the sand and niter, formed molten glass, which ran before the astonished eyes of the Phœnicians, who had thus discovered a new art.

This narrative of Pliny's must be taken as ben trovata, for the disillusionizing chemists tell us that the heat of an ordinary fire is not sufficient to cause sand to fuse, and that it was impossible for the Phœnician merchants to have generated the necessary 2,500° Fahrenheit by means of their dinner fire. But it is a good story all the same, although it differs from wine in not having improved with age.

He was a poor man, says the brilliant and versatile Kate Field, who, in Seneca's day, had not his house decorated in various designs in glass; while Scaurus, the Aedile, a superintendent of public buildings in ancient Rome, actually built a theater seating 40,000 persons, the second story of which was built of glass. That masterpiece of ancient manufacture, the Portland vase, was taken from the tomb of the Roman emperor, Alexander Severus, and should bear his name rather than that of the Duchess of Portland, who purchasd it from the Barberini family after it had stood three hundred years in their famous Roman gallery.

HOW VENICE LOST HER WORLD SUPREMACY.

Venice was without a rival in the art of glass making during the thirteenth century. Miss Field tells the story of how the monopoly was basely taken from the beautiful queen of the Adriatic. "No one," she says, "knows how long the City of the Doges might have monopolized certain features of this art but for a woman who could not keep a secret from her lover. Marietta was the daughter of Beroviero, one of the most famous glass makers in the fifteenth century. Many were his recipes for producing colored glass, and as he had faith in his own flesh and blood, he confided these precious recipes to his daughter. Alas for poor Beroviero! Marietta, after the manner of women, loved a man, one Giorgio, an artisan in her father's employ. History does not tell, but I have no doubt Giorgio wheedled the secret out of his sweetheart.

"Once possessed of these recipes he published and sold them for a large sum, then turning on the man he had betrayed, he demanded faithless Marietta in marriage. Thus it came to pass that the love of a weak woman for a dishonorable man helped to change the fortunes of Venice. The world gained by the destruction of a monopoly, one more proof of the poet's dictum that 'all partial evil is universal good.'"

BEGINNINGS OF THE INDUSTRY IN GREAT BRITAIN.

The theft of the Venetian's recipes was not the only factor at work in spreading the art of glass making. About 1450 a number of Venetian glass makers were thrown into prison in London on finding themselves unable to pay the money penalty imposed upon them by the Council of Venice for the offense of plying their art in a foreign land. Seeing no other way out of the difficulty, they asked that they be accorded the privilege of working out their fines—a project which was in accord with the views and wishes of the English king. The artisans were freed and allowed to work out their fine, and thus the beautiful art of glass making was added to the growing industries of Great Britain.

INEVITABLE GROWTH OF THE INDUSTRY IN THE UNITED STATES.

Step by step, gradually but inevitably, the art of glass making has been gravitating toward the United States of America, where the progress in the art has been such as to practically make us independent of the rest of the world. With due humility and all fairness, lest we grow over vain of our remarkable progress in the art, it must be said that we started with a vast and rich store of accumulated lore.

Equipped with better sand, Bohemia made clearer and whiter glass than Venice, thus wresting the laurels away from her, to lose them in turn to England when that country discovered flint or lead glass. The genius of American chemists has solved successfully the problems connected with the proportions and kinds of ingredients which go to make the best glassware, and thus by successive steps the nucleus of the art has been heading this way until it has finally established itself among us for an indefinite stay.

THE FIRST FACTORY IN AMERICA A GLASS FACTORY.

The first factory built upon the American continent of which we have record was a glass factory. It was erected near the English settlement of Jamestown, Va., and began its career with a humble output of bottles. There was no protection in those days, nevertheless the first manufactured articles to be exported from this country were none other than the bottles from that glass manufactory in the forests of Virginia.

This pioneer factory having died a natural death, was succeeded by others, some of which engaged in the manufacture of beads for the Indians, who have ever had a passion for these showy baubles. The Pilgrim fathers having settled in Massachusetts, the glass making art soon found a footing there, but does not appear to have thrived mightily, for we find in the records of the town of Salem that the town advanced to the glass makers the sum of thirty pounds, a sum which is not recorded to have ever been paid back. Thus early in our national career do we find record of an effort to create a boom in an industrial town by offering a bounty to a manufacturer. Somewhat later a glass factory was erected near Hanover Square, New Amsterdam, before the city came into the possession of the English and was given the name it now bears—New York.

PROGRESS OF THE INDUSTRY.

These early efforts to plant glass making on American soil were followed by more ambitious ones, and in 1787 the Boston Glass Company obtained from the Massachusetts Legislature the exclusive right of manufacturing glass in that State for fifteen years. So successful was this company that it was followed by others until, as the years fled by, Boston was able, in 1865, to manufacture glass that was equal to the best flint glass made in England. This was but the beginning of a success that was destined to develop into a triumph. As in other branches of industry America was preordained to lead the world in glass making, both as an art and as an industry of great magnitude.

In the purely industrial processes of glass making many notable improvements are to be recorded. The manufacture of green glass alone has witnessed many changes and the mode of production has been almost completely revolutionized. Where the old method of melting glass in pots took about twelve hours and the melting was conducted after the regular workers left in the evening, the operation of melting being an all-night process, the melting is now conducted differently. By the new process the glass is melted in tanks by a continuous operation, the melting being conducted at one end of the tank system, and the gathering and blowing at the other. The glass turned out by the tank system is lighter in color than the pot glass and, of course, the whole operation is conducted on a more economical basis, the furnace being in full blast day and night, with a day and night shift of blowers.

A marked improvement has been effected in the exterior finish of druggists' prescription ware, the improvement being due largely to the employment of petroleum and coal gas, which, although more expensive than the heat obtained direct from coal, is productive of better results so far as the finished appearance of the bottle is concerned. The stress of competition among glass bottle manufacturers has conspired to the use of methods for lightening the color of the glass, giving a shade more nearly resembling the flint, and doing away entirely with the old green color. The glass thus made is called Dutch flint, and while not equal to the poor flint glass, it is preferred to the ordinary green by the great bulk of customers.

In pure flint glassware the improvements have been in the direction of the manufacture of seamless bottles, while the quality of the glass itself is much superior to what it was ten years ago. The seamless bottles are now made very generally in factories, and the foreign article, which was formerly staple, is now almost entirely replaced by the domestic make.

THE CONSUMPTION OF PRESCRIPTION BOTTLES.

First, let us digress a moment to say that in no other country in the world is the consumption of glass bottles so great as in the United States. The reason for this is to be found in the greater material prosperity of the people of this country as compared with those of the Old World. Here it is not the custom to preserve a bottle after it has once served the purpose for which it was originally intended. In the case of prescriptions particularly, excepting, of course, renewals, a new bottle is supplied with each order, while in Great Britain and on the continent of Europe it is the customary practice for those who have prescriptions put up to present a clean empty bottle with the prescription. In making small or large purchases of liquid medicines the same custom prevails. An extra charge is made for the phial or bottle in all cases where the container is not furnished by the party making the purchase. This has led to the general use of second-hand bottles, which in the United States are usually destroyed, since no one would think of having a new prescription put up in a bottle that had once been used, or of bringing to the drug store and odd sized bottle for a certain specified quantity of a liquid drug.

BOTTLES IN USE IN THE BEGINNING OF THE CENTURY.

For prescription use practically only two kinds of bottles were in general use at the beginning of the century. In composition these bottles were of the commonest kind of green glass, while as to shape and appearance they were either long and slim like a phial or of a squatter form, round, and thicker than the phial. The neck varied considerably in both width and length and the lip was thin and irregular, making it difficult to deliver the medicine evenly. The size of the drop was never the same with any two phials, and the shape, or rather absence, of lip on the phial made it difficult to cork properly, a trickle generally contriving to steal over the side and disfigure the label. In those days the label was usually secured by one end to the neck of the phial by a string, the free end bearing the directions for giving the medicine flaring out at right angles to the phial itself.

The use of these bottles continued until fairly well on in the century, and they constituted about the only style of prescription bottle that was then available for the pharmacist.

THE DAWN OF IMPROVEMENT.

The old octagon shaped bottle had a certain vogue about 1825, but it did not completely replace the phial form. The awakening spirit of the century, which demanded improvement and still improvement in all the arts and trades, was felt equally in the apothecaries' business. Efforts were put forth in various directions looking to the improvement of the store, and the form and style of boxes received an equal share of attention. The old fashioned phials and octagon-shaped bottles were gradually discarded and the manufacturers began to furnish bottles of a more attractive appearance, an oval shaped bottle being among the earlier innovations in prescription ware. The bottles then began to be finished with a heavier lip, and the size of the mouth was regulated to a uniform model. Tools were used in

place of the old hand work and more regular results were thereby secured.

LATER IMPROVEMENTS.

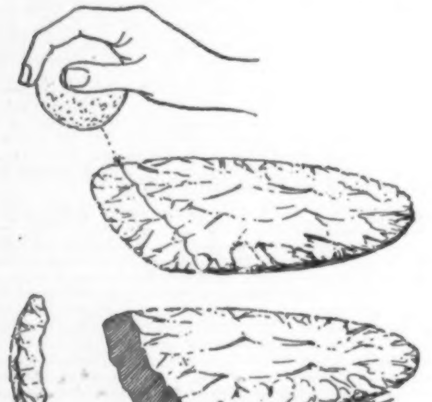
The next improvement in prescription ware was brought about in the substitution of flint for the common green glass. The first flint glass prescription bottles made their appearance about 1861, and from that time on the styles of prescription bottles began to increase and the finish to improve.

The first marked improvement in the shape of prescription bottles was the introduction of a tall four-sided bottle with beveled edges, which was called a French Square, and almost at once became popular all over the country. This was followed about 1867 by the appearance on the market of lettered bottles, that is bottles bearing on one side in raised letters the name and address of the pharmacist, accompanied in some cases by devices, monograms, etc. The lettering was molded on the bottles by means of a special device known as a plate mold. This consisted of a metal plate made of varying sizes to fit the various molds used in casting bottles of different shape.—American Druggist.

THE NEOLITHIC EPOCH IN ANCIENT EGYPT.

TRAVELERS, virtuosos and scientists, even, who have visited Egypt, have, up to the present, scarcely ever employed themselves in collecting flints bearing, to a greater or less degree, traces of an intentional cutting. With all their time and resources, they have not had enough to allow them to search for, uncover, free from rubbish, study and admire the numerous monuments of its long history. And had they desired to bring home some precious souvenir of their excursions through so many ruins, how could they have hesitated in the selection of the objects to collect? On all sides were offered to them carved and engraved stones, thousands of works of art, statuettes and jewels which were telling witnesses of the life of a people during ages, and which, in the beauty or strangeness of their form, preserved something of the mysterious attraction of the old ideas, obscure opinions and lively passions of their makers.

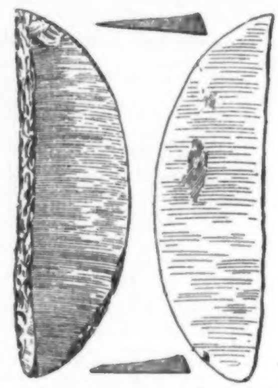
Almost everywhere in Egypt, it suffices to excavate with patience in order to be sure of bringing to light at least one curious relic or of finding the wherewithal



METHOD OF SHAPING THE NEOLITHIC AXES OF EGYPT.

to fill the showcases of museums. And such certainty of obtaining results and a recompense for one's efforts, in pursuing the routes that had already been followed, was well calculated to induce investigators to remain therein and not to enter those arduous paths that lead out of the domain of known history. Explorers have, therefore, properly followed the same route along the Nile, where life was active and where the vestiges of a brilliant past are innumerable. They have followed it without deception, if not without effort, their collections, which have been abundant, are constantly furnishing new food for our impatient curiosity. Nevertheless, they have not exhausted the monumental wealth accumulated upon the Nile. In the presence of numerous vestiges, all entering the limits of history and all accumulated in the same isolated place, every one has had the impression that this Egyptian civilization, so marvelous by its antiquity, so complete from its origin, so slow in its evolution, and so persistent despite external disorders, arose there all at once, miraculously attended with all those attainments, resources and arts that are everywhere acquired with great trouble and only gradually and tardily. Even now, when the subject is discussed, the instantaneousness and simultaneousness of the advent of all the elements of Egyptian culture are admitted. There has been nothing to prevent such an illusion, and we have as yet but little to dispel it. But we are, nevertheless, beginning to have something. In the presence of its historic past, so long and so old, no one dared to speak of the prehistoric past of Egypt; but, at present, such is no longer the case. Objects that have hitherto been scorned by reason of the rudeness of their form and the coarseness of their material are now collected. It has come to be understood that works of art are not everything in the life of a people, and that the supreme crowning of long efforts, produced at length, after numerous difficult attempts, do not teach us the history of these attempts. In the remoteness of the past, isolated with their work of a low order, which formed their support, they are like a magnificent mist stretched across the dark void of a desert scene. What has allowed us truly to understand their development has been the gathering around them of this work of a lower order by explorers, who, leaving the banks of the sacred river, not a very long time ago, went into the nearest desert far from the pyramids. The humble flint, discussed and scorned, was now sought for, and the harvest at once proved rich. We are now upon the track of an entire past wholly unknown, up to the present time, and that, too, the prehistoric past of ancient Egypt.

Through the few instruments and workshops discovered, we already know that man was here in quaternary times and occupied the heights at the foot of which the Nile excavated its bed. He inhabited the plateau that now forms the desert. From these eminences he gradually took possession of the river, in measure as the latter deposited its fertile ooze, which it obtained from the sea of Lower Egypt, and with which it supplied also the marshes luxuriant with vegetation that occupied its shallow coasts. While this fertile soil was thus forming and man was taking pos-



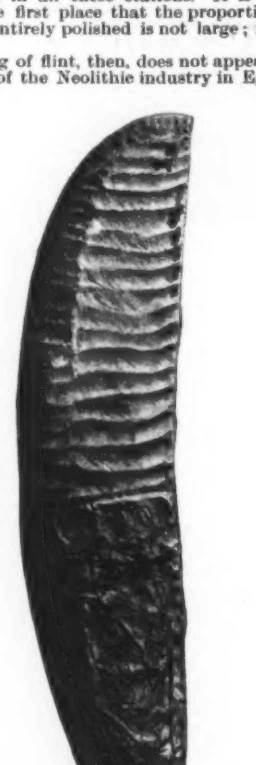
KNIVES OF YELLOW FLINT.
(One-half natural size.)

session of it, there was created in his hands what we have called the "Neolithic industry"; and while this industry was developing, human tribes were covering entire Northern Africa in great numbers.

In the statistics of the discoveries and prehistoric stations drawn up by M. de Morgan at least 53 different localities are noted in which tools have been gathered or the presence of Neolithic stations was otherwise indicated. These stations cannot have been the site of villages of isolated tribes. They cover the whole of Egypt, at least from the vicinity of Cairo, on the southwest. They bear witness to the existence of quite a dense population, which, at all events, occupied especially the left bank of the Nile, from the confines of Nubia to those of the delta, and which became so greatly developed there as to reach a definite and stable civilization.

Let us for an instant examine the innumerable stone tools gathered in all these stations. It is to be remarked in the first place that the proportion of the axes that are entirely polished is not large; in fact, it is quite small.

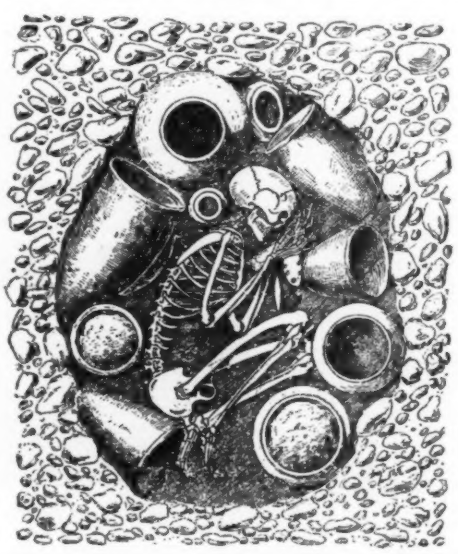
The polishing of flint, then, does not appear to be a characteristic of the Neolithic industry in Egypt as it



FLINT KNIFE WITH A GOLD SHEATH.
(Museum of Gizeh.)

does in Europe. In certain localities, such as El-Toukh, the shaping of these instruments remained so rude that, if they had not been found mingled with Neolithic objects, they might have been considered as Chellean axes. M. de Morgan, indeed, thought it a question whether they ought not to be classified in the quaternary. The genuinely Neolithic types quite strongly recall those of the Danish Kjœkken-Mœddings, since they are narrow on the side designed for the handle and wide on the cutting side; but one of the faces is plane. The edges are quite finely touched up. M. de Morgan believes that these axes are peculiar to Egypt. With them are classified some flaked axes that have the form of the polished ones. There are no flint axes that are entirely polished; flint axes having a polished cutting edge have been found at Faydoum. M. de Morgan has discovered these nowhere else but here. The wholly polished axes are of hard stone, such as diorite, serpentine and hematite. They belong to Upper Egypt, where, however, it was the simply flaked axes that were in current use. As a whole, and apart from the specimens cut after the introduction of metal, these Egyptian axes very closely resemble the types of the south and center of Europe and of the north and center of Africa and Syria. The Egyptians had, moreover, a special method of forming the cutting edge of their axes. This edge, having been once formed by small flakings, with a single blow delivered at the side, they removed the whole of this first edge by a large transverse flaking, which left as the final edge a very sharp bevel. Polishing was incapable of giving so sharp an edge, and that is, perhaps, why it was so little employed. By far the most common tool in the Neolithic stations of Egypt was the blade of flint. This possesses various forms and dimensions and must have been used for a host of purposes. But the most widely distributed form is that of the knife. The cutting of the knife is often of extraordinary perfection and of great boldness. There are knives of which the cutting edge is very sharp and regular, and that reach a length of about eight and a half inches. "The Neolithic stations of Europe," says M. de Morgan, "furnish nothing to be compared with these large knives, while the Magdalenian of the Dordogne presents touched up flakings in all respects like those of Egypt. There are, nevertheless, Egyptian blades sharp on both sides that exhibit the greatest analogy with the Robenhausian of Europe. Finally, there are true knives with convex blade and a straight, thick back. There are some even with a shank for hafting and with a handle shaped out of flint. Their aspect is so much like that of our metallic knives that one would be tempted to believe, as has for a long time been believed without any accurate proof, that they remained in use during the first period of history."

There are large blades so strongly curved as to resemble a sickle. These come especially from Abydos and El-Amrah, and are chipped with such regularity



PREHISTORIC TOMB OF THE NECROPOLIS OF EL-AMRAH.

that the flakings, symmetrically removed on each side of the median line, give the face a scaly appearance. The Museum of Gizeh possesses one of these pieces, which is provided with a sheath of stamped gold four inches in length.

Workmen who were capable of attaining the manual skill necessary for such a manufacture were also capable of learning how to carve cups and statues with very rudimentary tools. Despite the diversity and abundance of blades and knives, there are also in the Neolithic stations of Egypt scrapers of all shapes and of all the forms of Europe. Those of Abydos, which are double and worked out of a two-edged blade, are absolutely identical with the scrapers collected in the caverns of Dordogne, in the Solutrean and Magdalenian strata. There are no scrapers peculiar to Egypt.

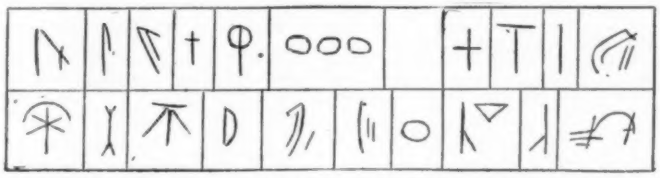
The Egyptian spear and javelin heads are especially of the Solutrean type, save that, instead of having a straight cutting edge, they are provided with very fine saw-like teeth, as in the Neolithic of Scandinavia and Denmark.

The Egyptian arrowheads all have the form of those that belong to the Neolithic of Europe. There is, according to M. de Morgan, no comparison to be established. The types are identical here and there. It is assuredly a remarkable fact that all the forms are common to Egypt and Europe; and it is all the more remarkable that in Egypt even there is a complete difference between the Neolithic and Pharaonic arrowheads. These latter must have continued in use up to an epoch bordering upon our era. They are simply very small chipped flints that were not shaped especially for the purpose for which they were used. They have nothing in common with the Neolithic arrowheads, which were shaped with great care and art. "From the numerous representations of arches found upon the monuments, we know that these sharp flakes have always been in use, while the heads do not seem to have been employed by the Egyptians long after the beginning of the ancient empire."

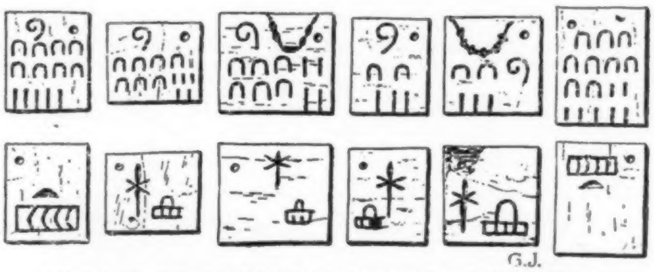
The primitive Egyptians manufactured genuine saws from flint, as well as from bone; and from small flints they made sickles with denticulated blades. These remained in use during the ancient empire up to at least the third dynasty. Their abundance proves the extent

of the culture of cereals, which were reared therewith. M. de Morgan hesitates as to the antiquity of such culture. He has found grains of wheat and barley only in the royal tomb of Négadah and at Kawamil. But that suffices to establish the existence of the culture of these cereals at the Neolithic epoch.

Handmills, formed of two stones, one rolling upon the other, employed under the ancient empire, and up to the present time in Nubia, date back to this epoch. If we rely upon this summary examination of the stone tools of Egypt, we acquire, despite its gaps, the conviction that the Neolithic age was of sufficient duration to allow all of its principal types to be spread to a distance from the circumference of the Mediterranean. Egypt probably played a part in the invention and diffusion of these types, but we cannot as yet fix its rights of priority, and have not even a positive proof of their existence.



MARKS OBSERVED UPON THE CLAY JARS OF THE ROYAL TOMB OF NÉGADAH.



IVORY TABLETS WITH INSCRIPTIONS OR NUMERICAL SIGNS FROM THE TOMB OF NÉGADAH.

All that we can give as certain, and that, too, after setting aside the European coasts and islands of the Ægean Sea, is that, in Europe, the thinly scattered population remained fixed in its industrial types, yet performing, by certain of them, work of admirable fineness and patience, while in Egypt a denser population, devoted to agriculture, diversified the form of its tools and multiplied the number of them. The progress in Egypt was more rapid, and sedentary life was also surer, easier, and more regular. The conditions necessary for civilized societies, too, were sooner realized there. Such is the evidence. It is precisely on account of this that the length of Neolithic time is less apparent there. A complete civilization had already conquered Egypt, when in almost the whole of Europe the stone industry still existed to the exclusion of any other.

It is especially in the funeral materials that the superiority of Egypt was displayed in those remote times. In the most ancient tombs found, and which are abundant in Saïd (Toukh, Négadah, El-Amrah, and Kawamil), the bodies, after being bent nearly double, had been wrapped in sewed gazelle skin and then in a rush mat, and placed amid pottery, weapons, tools, and jewelry, without any other precaution, in holes dug in banks of gravel between the mountain and the plantations. The funeral costumes were afterward modified.

In the tombs that partially succeeded the preceding, and which have occasionally yielded, here and there, a little bronze (copper) and gold, the bodies had been partly or completely deprived of flesh before burial, and the head was generally separated from the trunk. The tombs sometimes had the form of boxes the sides of which were made of sun-dried bricks, or that of rectangular troughs made of beaten clay and provided with a cover. In these tombs, the bones were placed promiscuously. Finally, there were also tombs that consisted of large vases in which the bodies, lying upon the back, had been bent with the limbs in the air.

It is not possible to confound these sepulchers with the Pharaonic ones, in which all the parts of the body (with ritual exceptions) were preserved in place with great care, and in which the entire body was mummified. Nevertheless, traces of bitumen have been noticed upon the skeletons of the ancient tombs of the second category.

The contents of the most ancient tombs consisted of rude vases containing débris of offerings, vases of red clay, often painted black upon the edges, and in the interior yellow vases painted red, rude vases of hard stone or alabaster, slabs of schist sometimes representing animals, cut sile, and rude jewelry of ivory, bone, mother of pearl, or camelion.

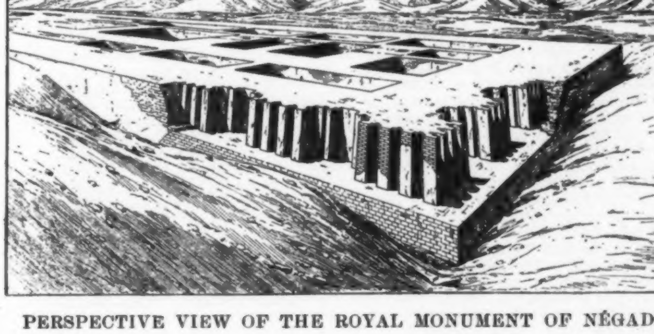
Vases of red clay are rare after the Neolithic epoch. They are very skilfully made by hand out of very fine paste, and are polished on the surface, but are porous and but slightly baked. They are decorated with white paintings representing men, animals, and branches, or simple geometrical lines. Their forms are extremely varied, and by very reason of their variety, are beyond all description. Some of them, with ovoid bottom, were incapable of standing upright without the aid of supports.

The yellow vases painted red are still more remarkable. They are as well manufactured as the others, and are ornamented with red paintings that are more correct and artistic. They made their advent shortly after the preceding, but are essentially Neolithic.

In the tombs containing bodies that had been previously stripped of flesh, painted pottery gives way to gray pottery and cylindrical vases. Such substitution is accompanied by the gradual abandonment of stone material. But it appears that it is only dating from the fourth dynasty that the ancient funeral customs of tombs with excarnated bodies, or intact ones assembled in an embryonary position, gave way before the mummification necessitated by the religious beliefs disseminated by the priests and the upper classes.

The apogee of Neolithic civilization in Egypt, or, more properly speaking, such civilization at the time when it produced its most perfect work, is admirably represented by the material collected in the excavations of the royal tomb of Négadah. This latter is situated upon the left bank of the Nile, a little to the south of Abydos, in the very heart of the region that has been sufficiently designated as the center of the most ancient civilization of Egypt.

It was in 1897 that M. de Morgan, applying himself to a methodical exploration of the environs, brought to light, beyond the limit of cultivated land, upon the confines of the desert, to the north of a necropolis already partly excavated, a monument of sun-dried bricks of the most archaic character. This structure had been submitted to the action of an intense fire, which, as could be easily seen, had been started at the very moment of the burial of the person for whom the structure had been erected. M. Amélineau had observed traces of similar fires in his excavations at Abydos. He was, therefore, convinced that this burial with fire was a funeral rite reserved for the kings before the Pharaonic epoch. Such had been the intensity of the heat at Négadah that the vases of granite, porphyry, and clay had been vitrified. By good luck, all the objects inclosed in the funeral halls had not been destroyed. The following was the arrangement of these halls: The entire monument, a rectangular structure 177 feet in length by 88·5 in width, was constructed of sun-dried bricks, cemented with Nile ooze and coated with earth without any painting or whitewashing. The structure, which was crenelated on the exterior, was divided into chapels, which recalled the aspect of the steles of the ancient empire, but which had been concealed—closed even, by a wall. In the interior, and in the center, was arranged a nearly square chamber, on each side of which, in a lengthwise direction, were two smaller rectangular rooms. These five central chambers were surrounded by sixteen small rectangular rooms, six on each side, lengthwise, and two at each end. According to what M. Amélineau observed at Abydos in a sepulcher of the same kind, but larger, it is to be supposed that all these rooms were originally covered with unhewn timbers supporting a terrace. This roof must necessarily have fallen in at the time the fire was lighted above and around the monument. In the center of the large middle hall, M. de Morgan found some calcined bones, the remains of the body that had been buried. In the other rooms, there were no similar remains, but the central halls were full of vases and objects of every nature. Only a single one of the other halls contained an interesting collection. Probably we have thus a full complement of the richest industrial material of the epoch to which the royal tomb of Négadah belongs.



PERSPECTIVE VIEW OF THE ROYAL MONUMENT OF NÉGADAH.

In the lengthy list of objects collected by M. de Morgan in the sepulchral chambers of Négadah, under a thick stratum of ashes, were a copper button, a copper bead, a copper wire, numerous beads of glass paste and of paste of blue enamel, and even a long bead of gold. This last-named metal was, therefore, beginning to be known, but up to this historic period only copper was known. It was through error that it was once believed that the tools of this metal were of bronze. Now, copper could only be used for delicate tools, such as needles, and at Négadah there was not a tool made of this metal. Flint tools, on the contrary, were as numerous as they were varied. Thus, there are enumerated 104 pieces, either entire or in fragments. Among these there are scrapers, or what are called such, knives, blades of very large dimensions, awls and punches, without mentioning indeterminate objects. There are also punches of fishbone, an ivory or bone needle, a grindstone, a mortar of rose colored granite, terra cotta beads, etc. The objects, all of them of the stone age, represent, numerically, a proportion of the finds difficult to figure, but certainly a large proportion. No one, we think, has disputed the fact that this circumstance suffices to prove that the people of Négadah were still in the stone age. They were, moreover, extraordinarily skillful workmen. Some of the Négadah objects of ivory, plates with inscriptions, furniture, legs imitating those of bulls, and reproductions of fishes, dogs, and lions are true works of art. And all these pieces and others of hippopotamus ivory, along with pieces of furniture made of ebony, give the impression of an industry of too slight primitiveness to be included in our ages of stone. But it is not only the stone tools which accompany them that render us certain as to their age, but also the vases, for example, which are like those of the poor Neolithic tombs.

Along with amphoræ, or large jars,* 30 inches in height, that filled the entire halls, and are made of fine clay well tempered and baked at a high temperature, there were numerous vases of coarse earth like those above mentioned; and alongside of smooth yellow and fine gray pottery, perhaps not known previously, there was the red pottery painted black, characteristic of the more ancient tombs, but already less widely distributed. With this ceramic ware, there has, it is true, been found also a large number of vessels of hard stone. Very diverse materials, some of which were extremely difficult to work, were used in the manufacture of these vessels. According to the determinations of MM. Friedel and Fouquet, among such materials were diabase, porphyry, quartz, a carbonate of magnesia called geobertite (very rare), quartziferous diorite, dolerite, alabaster, and even obsidian, called volcanic glass, which is abundant in the Grecian islands, but which appears to have been always rare and considered as very precious in Egypt. These substances, so difficult to work, were shaped with a care and patience such that the question has been asked whether the Egyptians did not have recourse to processes that are unknown to us. But we now know that their processes were, on the contrary, very simple, and that stone tools sufficed them. The shaping alone of some of their flint blades was, moreover, in itself as wonderful a work of manual dexterity and of patience as the manufacture of the hardest vases and most finished statuettes.

For the foregoing particulars and the illustrations we are indebted to the Revue Encyclopedique.

EARTHQUAKE-SOUNDS.

By CHARLES DAVISON, SC.D., F.G.S.

THE sound which accompanies an earthquake has rarely, if ever, been described more graphically than by an observer of the Charleston earthquake of 1886. He was at the time on the second floor of a lofty building in Charleston when his attention was "vaguely attracted by a sound that seemed to come from the office below, and was supposed for a moment to be caused by the rapid rolling of a heavy body, as an iron safe or a heavily laden truck, over the floor. Accompanying the sound there was a perceptible tremor of the building, not more marked, however, than would be caused by the passage of a car or dray along the street. For perhaps two or three seconds the occurrence excited no surprise or comment. Then by swift degrees, or all at once—it is difficult to say which—the sound deepened in volume, the tremor became more decided, the ear caught the rattle of window sashes, gas fixtures, and other movable objects. . . . The long roll deepened and spread into an awful roar, that seemed to pervade at once the troubled earth and the still air above and around. The tremor was now a rude rapid quiver, that agitated the whole lofty, strong-walled building." Soon "the floors were heaving underfoot, the surrounding walls and partitions visi-

* These contained bunches of grapes, wheat, barley, and flour.

bly swayed to and fro, the crash of falling masses of stone and brick and mortar was heard overhead and without, the terrible roar filled the ears and seemed to fill the mind and heart, dazing perception, arresting thought . . . ," until at last "the uproar slowly died away in seeming distance. The earth was still, and oh! the blessed relief of that stillness!"*

Though the chief features of the earthquake-sound are described in the above extract, its character varies considerably in different earthquakes, in various parts of the area of one and the same earthquake, and even with individual observers in the same house. For several years I have paid special attention to the phenomena of earthquake sounds† and have collected several thousand descriptions, the types of comparison employed belonging generally to one of the classes mentioned below. Occasionally, however, an observer is uncertain, and quotes alternative types which may belong to different classes. But often the resemblance is so close that he is himself deceived, and starts up from his chair to see the unexpected carriage pass.

1. The most frequent references of all are to passing vehicles of various kinds, and, as a rule, to very heavy ones, such as traction engines, steam rollers or wagons, driven rapidly over stone paving or on a hard or frosty road; express trains or heavy goods trains rushing over an iron bridge or through a tunnel or cutting; or weighty furniture dragged along the floor. 2. Next in frequency come comparisons to thunder, occasionally to a deep peal, but most often, perhaps, to distant thunder. 3. In some earthquakes, but by no means in all, the sound appears to resemble a rough or moaning wind, the howling of wind in a chimney and a chimney on fire. 4. When it is of short duration and fairly uniform in intensity, we find the sound described as like that of a load of coal or bricks falling from a cart, or of a wall or roof tumbling down. 5. Again, when still briefer, it is compared to the thud of a ponderous weight, a large mass of snow or of heavy timber, or the slamming of a door. 6. In weak earthquakes, and above all, in the slight after shocks of a great earthquake, we have references to explosions of different kinds, but chiefly to colliery explosions, rock blasting or the firing of artillery, especially when they occur at a distance. 7. Lastly, there are several descriptions of a miscellaneous kind, which are rarely used and do not fall under any of the above headings, such as the tramping of many animals, a covey of partridges on the wing, the roar of a waterfall or the rumbling of waves in a cavern.

To most observers and over the greater part of the disturbed area, the sound remains of the same character throughout. There is nearly always a very perceptible change of intensity, the noise growing gradually louder and then dying away, and the change sometimes takes place so uniformly that it seems as if a carriage were coming up rapidly to the door of the observer's house and afterward receding on the other side. Close to the epicenter (or area vertically above the seismic focus), a change in the character of the sound is also noticeable at or about the instant when the shock is strongest; some hear a loud crash like the explosion of a bombshell; to others, it appears rougher and more grating; while a large number perceive no change at all. At moderate distances, the changes are much less marked, before and after the shock, the sound resembles the moaning of the wind, and, while the shock lasts, a more rumbling character is developed. At great distances, the change in character is hardly sensible; there is little, if any, variation in intensity, and the report, when heard, resembles more than anything else the deep bomb of distant thunder.

The extraordinary depth of the sound is shown very clearly by the descriptions given above. The frequent and unprompted use of the word "heavy," whether applied to thunder, explosions, or traction engines, is some evidence of this. The same impression is also conveyed by the more detailed accounts; "much lower than the lowest thunder," one observer writes, and another, "I can only compare the sound with the pedal note of a great organ, only of a deeper pitch than can be taken in by the human ear, shall I say a noise more felt than heard?" Still more striking is the fact that, while the sound is heard by some observers, it is quite inaudible to others at the same place and even in the same house. To one person the sound is so loud that it seems like the rumbling of a heavy traction engine passing; another in the same place and equally on the alert will be just as positive that the shock was unaccompanied by sound. The explanation offered rather confidently by some writers that the attention of the second observer was distracted by the shock is untenable for several reasons, which may be worth mentioning. 1. In the first place, the sound is often too loud to escape notice in this way. 2. It is generally heard before the shock begins to be felt. 3. Different races, as will be seen afterward, vary much in their powers of hearing the earthquake sound. A whole nation, and especially one so accustomed to observing earthquakes as the Japanese, cannot be accused of constant inattention. 4. Lastly, my own hearing is, I believe, unusually keen for ordinary noises, but I could hear no sound during the Hereford earthquake 1896, though I was in a quiet room and listened intently, and more than 60 per cent. of the observers in Birmingham heard the earthquake sound. We may, therefore, conclude that the inaudibility of the sound is not due to inattention, but simply to the fact that some observers are deaf to very low sounds.

Another fact deserving of notice is that the sound-vibrations are not all of one pitch. The loud and deep explosive crashes observable near the epicenter at the time when the shock is strongest are only heard by some persons. Again, the observers at any one place make use of widely different means of comparison. Thus, out of more than fifty observers of the Hereford earthquake in Birmingham, 35 per cent. compared the sound to passing wagons, etc., 18 per cent. to thunder, 17 to wind, 4 to loads of stones falling, 9 to the fall of heavy bodies, 11 to explosions, and 6 per cent. to miscellaneous sounds. The difference in loudness was also very marked. On the one hand, we have such descriptions as a traction engine passing, and express train rushing beneath an arch, a heavily laden cart passing over a rough street, and heavy thunder; on the other, distant thunder, a rushing wind and a very distant explosion. If all the observers in one place were equally endowed, the sound would present the same character to every one of them. But their powers differ widely. Their ears, indeed, act like sieves of varying degrees of fineness; some are affected by many vibrations, and to them the sound is loud and complex; others are impervious to all but a few vibrations, and they hear a sound that is apparently faint and monotonous.

As the inhabitants of any one country do not agree in this respect, it is only natural to suppose that different races should also vary. The people of Great Britain seem to have unusually good powers of hearing earthquake sounds. It may fairly be said that an earthquake never occurs in these islands without the sound being heard. It is not altogether easy to make a just comparison with other nations, for we cannot be certain that the omission of sound-records is not accidental. There are, however, two countries, Italy and Japan, where earthquakes are closely studied. In Italy about one-third, and in Japan about one-quarter, of the earthquakes seem to be accompanied by sound. But there is this difference between them. The Italian shocks, which are unattended, so far as we know, by sound, are generally felt by very few persons; when there are many observers, there are always one or more to be found among them who are capable of hearing deep sounds. But, in Japan, although the proportion of audible earthquakes increases with the area shaken by them, nearly one-third of the strongest shocks are unaccompanied by any recorded sound. The only inference we can make from this is that the Japanese, as a race, are less susceptible than Europeans to very low sounds.

The more or less limited size of the area over which the sound is heard is also evidence of the less or greater deafness of observers for low sounds. In Great Britain, the sound is heard with every earthquake, and by a large proportion of the observers who feel the shock; and here the sound-area is always large. In weak earthquakes, the noise is heard farther than the shock is felt; in strong ones, it has been heard as far as 180 miles from the epicenter. In Japan, on the other hand, the sound is inaudible at a distance of a few miles from the epicenter. Of the earthquakes which originate beneath the land, about one-quarter are accompanied by sound; while this is the case with less than one per cent. of those which have submarine foci, although more than nine-tenths of the epicenters were not more than ten miles from the coast. Indeed, so deaf are the Japanese to the earthquake sound that it is probably heard by them only in the case of those shocks which originate at a very slight depth below the surface of the ground.

In all countries, however, the sound-area is less than the disturbed area of a strong earthquake; and in a disastrous earthquake it may occupy only a comparatively small region in the neighborhood of the epicenter. But there is no constant relation between the two areas; for, in moderately strong or weak earthquakes, they nearly coincide, or the sound-area, even overlaps the other on one or more sides; while in a very weak earthquake, it overlaps it in all directions. Moreover, there are some very interesting cases in which the disturbed area ceases altogether to exist, that is, the sound is heard while no shock whatever is felt.

That such earth-sounds have the same origin as ordinary earthquakes is highly probable. They are heard in districts where slight shocks are frequent; and sometimes a series of earth-sounds is interrupted by a shock accompanied by a precisely similar noise. A great earthquake is always followed by a crowd of after-shocks, among which earth-sounds occur in great numbers at places near the epicenter. It would, therefore, seem that earthquakes and earth-sounds may be traced to the same cause, that the chief difference in reality lies in ourselves, in the sense by which we perceive them—in other words. that an earth-sound is merely an earthquake too weak to be felt.

A point of some importance is the relative position of the sound-area and disturbed area, of an earthquake. So far as known the two areas never have the same center. Their longer axis are parallel to one another, but the sound-area is always displaced with respect to the other, sometimes in the direction of the longer axis, but generally in that of the shorter axis. In the latter case, moreover, the displacement takes place toward the line of the fault with which the earthquake appears to be connected, implying that the loudest sound vibrations do not come from so deep-seated a portion of the fault as the vibrations which constitute the earthquake shock.

In old earthquake catalogues, the sound is generally said to precede or accompany the shock, very rarely to follow it; in Japan, the sound is seldom, if ever, heard after the shock ceases to be felt, but it is nearly always heard before the shock begins. We may fairly infer from this that the fore-sound is louder than the after-sound. More detailed studies of recent British earthquakes show that the beginning of the sound generally precedes that of the shock in all parts of the sound-area; while the end of the sound more frequently follows that of the shock than otherwise, even at very great distances from the center. In weak earthquakes, the instant when the sound is loudest always coincides with that when the shock is strongest; and this is generally, though not always, the case with strong earthquakes. The duration of the sound is as a rule obviously greater than that of the shock.

In order to give definiteness to the explanation of the phenomena described above, I will assume the truth of the theory which ascribes non-volcanic earthquakes to the friction produced by the sliding of one of the rock-masses adjoining a fault over and against the other. The seismic focus in such a case must be a surface inclined to the horizon, and the relative displacement of the two rock-masses will be greatest near the center of the focus and will die away toward the edges. Thus, from all parts of the focus, there must proceed vibrations differing in amplitude and period, the large and slow vibrations coming from the central region, and the small and rapid ones from the margins. It is the latter, I believe, especially those which come from the upper and lateral margins, which are responsible for the earthquake-sounds.

It is evident, on this view of their origin, that the sound will become gradually louder until the shock is felt, and afterward die away. The intensity of the sound will also increase with that of the shock in different earthquakes; but while the marginal vibrations are limited in amplitude and period, those from the central parts of the focus have a wider range, and, therefore, the intensity of the sound will not be proportional to that of the shock. Similarly, in a violent earthquake, the disturbed area will extend far beyond the sound-area; while, in a weak earthquake, the latter area will overlap the former. In the limit, the central region of the focus will vanish, and the sound will be heard without any accompanying shock.

The most perceptible sound-vibrations will be those which come from the upper and lateral margins of the focus, and the boundary of the sound-area, with respect to that of the disturbed area, must, therefore, be shifted toward the fault-line, and also in the direction of the fault, if one lateral margin be longer horizontally than the other.

The sound-vibrations from the margin nearest to the observer will be heard before the shock begins, those from the upper margin and the central region during the shock, and those from the farthest margin after the shock ends. Thus, the fore-sound, on account of its nearer origin, will be more generally noticed than the after-sound; and for the same reason, will be the only sound heard by Japanese observers. The after-sound will be less frequently heard as the distance from the origin increases; and the duration of the sound, especially at places near the epicenter, will be greater than that of the shock.—Knowledge.

* C. E. Dutton, Amer. Geol. Survey, Ninth Annual Report, pp. 212-213.

† See a paper in the Phil. Mag. for January, 1900, of which the present paper is an abstract.

TOBACCO.

M. Lehеup recently published, in the Revue des Sciences, a paper on this subject, of which the following is a resumé:

Tobacco, says M. Leheup, is in France (and in several other countries) one of the chief sources of revenue to the State. From year to year the amount accruing from this source to the public coffers has constantly augmented, the increase being due partly to increased consumption, but more particularly to improved mechanical methods in handling and manufacturing the article, and hence in its net cost to the State—and this, in spite of an almost constant increase in the pay-roll of the employees. The probability is a still further decline in the price to consumers.

In despite of all attempts in that direction heretofore made, certain mechanical processes have resulted in failure, and especially is this true in the attempts to make cigars by machinery. Some progress in this direction has, however, been made, enough, at least, to warrant the hope and belief that the problem is solvable, and that it cannot much longer resist the ingenuity and untiring efforts of the men engaged in the task of solving it.

TOBACCO CULTURE.

Attempts at the culture of tobacco have been made in every European country, and with only partial success. In some countries almost complete failure has met every effort. In Portugal, for instance, whose climate would warrant the anticipation of good results, the quality of the product is exceedingly poor. As everybody knows, Cuba sets the standard for the world, the so-called "Havana" tobacco being justly regarded as the finest produced anywhere. In all there are no less than seventeen gradations in the quality of commercial tobacco, ranging from the lowest, the refuse minced up for use in the manufacture of cigarettes, up to the large, beautiful leaves used as wrappers for the best cigars.

Mexico produces a clammy sort of tobacco, frequently somewhat bitter to the taste, and having but little aroma. The Brazilian product, on the contrary, is of excellent taste and high aroma. The United States is one of the largest producers of tobacco. Maryland and Ohio tobaccos are light, while the leaves of Virginia and Kentucky are large and coarse. They are both used (in France) for the manufacture of snuff, as well as chewing tobacco, and are also employed in making cheap cigars (cigares a un sous, or, literally, "cigars at one cent"—"one-fors"). In the northern part of the Union, latterly, many interesting attempts have been made in the direction of acclimatizing the Havana seed.*

Java and Sumatra produce a fine light tobacco, which is mostly used in wrappers for the better quality of cigars. Manila (now the property of the United States) sends us ready-made cigars (and also a not by any means contemptible quantity of fine leaves for wrappers.—Editor National Druggist.

Turkey and Asia Minor produce a tobacco of clear yellow or golden color, with a peculiar and very pronounced aroma.

The processes of culture and of curing the leaves vary from country to country. In France the culture is regulated by very strict and severe rules. The soil planted in tobacco must be thorougly prepared, and the plants must be protected, not only against the cold, but the heat and the winds. Germination is generally effected in hotbeds, and transplanted when of the height of 10 centimeters (say 4 inches). When the top-button, which announces floration appears, the planter removes it with his finger nails (i. e., pinches it off), a process technically called l'éçimage (i. e., "topping"), and also the buds which sprout from under the axils of the leaves. After this, the soil around the plants must be loosened with rakes, dressed, earthed up ("hilled"), and finally stripped. The maturity of the leaves is indicated by a yellowish marbling, which appears under the parenchyma. When this occurs they are at once gathered. In France each leaf is stripped by itself. They are next "bunched" by arranging them either on a string or around a wooden staff. Drying proceeds under sheds open to the air, or in desiccators, according to the locality, or the weather. They are then sorted, put in bundles first, and subsequently balled and stored.

* The author seems not to be acquainted with the progress made within the last three or four years in acclimatizing the Havana plants (i. e., transplantations of Cuban growing plants) in Florida. During the Spanish regime it was made a crime, or a high misdemeanor to remove growing tobacco plants from the island. Certain expatriated Cubans living in or near Key West, we learn, managed, in spite of all interdicts, to secure plants of this kind, and set them out in soil especially adapted to them, and with considerable success, as we are informed.—Editor National Druggist.

MANUFACTURE.

Tobacco goes to the public (in France) under five forms, viz.: Snuff (tabac à priser), a powder; chewing tobacco, in rolls or carottes (plugs); smoking tobacco ("scaferlate," minced), cigars, and cigarettes.

In France the details of manufacture have arrived to the highest degree of perfection, both in the quality of the products turned out and in the simplification of the processes which have, as we remarked before, become almost entirely mechanical and very largely automatic, thus requiring a comparatively small force of skilled and unskilled operators.

The leaves used in the manufacture of snuff are those known as corsés (i. e., heavily veined), which are chosen for their relatively high content in nicotine. The leaves are moistened with salt water, and then chopped fine, after which they are allowed to undergo fermentation in mass. From the first to the last operation—their reduction into snuff—a period of between sixteen and seventeen months is required.

The conversion of the dry leaf into chewing tobacco is much simpler, comprising the dampening with salt water, compression, and twisting on the wheel.

Smoking tobacco is largely a mixture of light varieties of leaves possessing high aroma. The first step here is also moistening or wetting with salt water, and this is subsequently repeated, in order to avoid waste (i. e., from pulverization of the leaf). The leaves are then arranged in piles (technically called capsées), one leaf upon another, for convenience in cutting, and carried to the hachoir or "hashing" machine. The excess of moisture, added to the leaves for convenience and to prevent waste in cutting, is then got rid of, as its retention injures the quality of the product. This was formerly accomplished by torrefication, but is now done by mechanical means (centrifugal machines). The finished product is then put up in packages of 40, 50, 100 and 500 gm. each.

Cigarettes of the best sort—the cigarettes de luxe, are made by hand. The tobacco is introduced into a hinged mold, compressed slightly, and then forced into the paper enveloping tube. The commoner kinds are made entirely by machinery, which by the way, has been brought to a high degree of perfection. There is a third variety of cigarettes now made, and which have attained almost to the dignity of a cigar. In these the paper envelop is surplanted by a film made of tobacco, which is wormed spirally upon a core of cut tobacco.

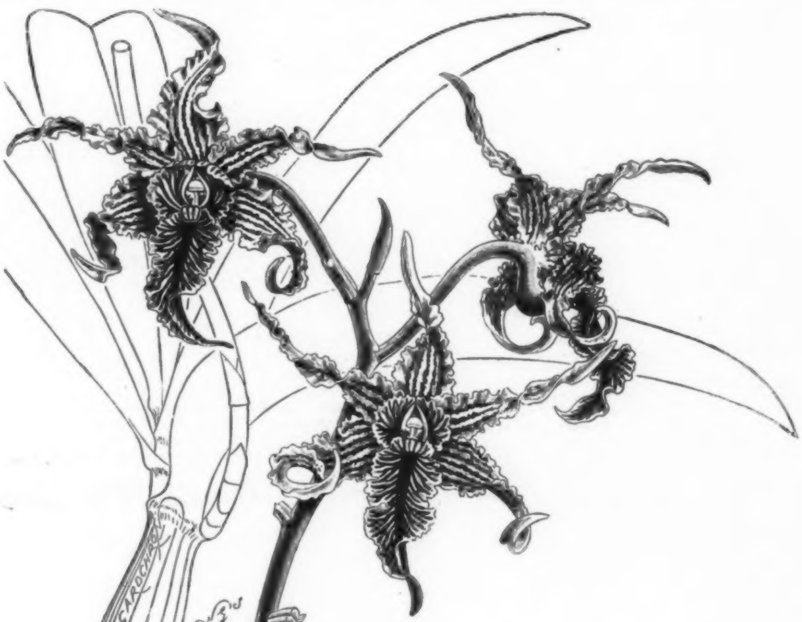
As to cigars, up to the present all good ones are made entirely by hand. Every cigar consists of three parts: the core or filling—bits of tobacco of the length of the cigar to be made, and débris sufficient to give a proper volume and shape; the inner wrapper, which surrounds the filling (technically called the "tripe"), and the wrapper (in French, "robe" or "cape" which is wound hilically around the whole mass. Molds are used for guidance in making cigars, in order to insure uniformity of size.

The culture, manufacture and sale of cigars constitute a government monopoly, and no one is permitted to enter upon either, except under governmental direction and supervision. There are in all twenty establishments where the various products are manufactured. In all there are 726 préposés, or overseers, male and female, charged with the supervision of the workmen and women employed, amounting to 15,037 individuals all told, of whom 13,008 are females. The consumption of the product is constantly and steadily increasing. In conclusion, we may add that in the factories and workshops the government has done all that could be done toward the preservation of the health and well-being of the employees, and that the institutions may well serve as a model for similar buildings, etc., in other lines of manufacture.—National Druggist.

The New York Evening Post, in presenting the views of a dealer in honey on the yield of that sirupy product observes that for the first time in many years the honey yield in this country has practically failed. Dealers report frequent and large importations from Jamaica, Mexico and Europe to supply the demand. This year's home supply of comb and liquid is less than last season's, which was small enough; following the scarcity of 1898, it has spread consternation among bee owners. Further comment on the situation elicits the following: "It is safe to say that honey has advanced 40 per cent. in price in two years; in some cases it has doubled. Two years ago it was selling for a little more than four cents a pound; to-day it commands nine cents. The falling off in quantity of this season's product is very great. In 1897, New York city, received from California 500 carloads; in 1898, 100, and in 1899 about 60. In the east, Vermont has produced nothing, and St. Lawrence County in New York, which sent us 4,000 crates in 1898, furnished last fall about 200. Clover-comb honey has risen from 12 to 16 cents a pound and buckwheat honey from 8 to 12 cents. At present it pays to import foreign liquid honey, with a duty of 20 cents a gallon."

DENDROBIUM SPECTABILE.

WE illustrate herewith, says The Gardeners' Chronicle, the new species of Dendrobium shown at the meeting of the Royal Horticultural Society on December 19, from Major Joicey's collection at Sunningdale Park. This plant was figured in Rumphia as Latourea spectabilis, the flowering of which, out of Messrs. Sander's recent importation from New Guinea has been looked forward to with interest. The flowers, which are produced on upright spikes, are large, and singularly formed, the labellum taking much the same form as the other segments, though being the largest. The septals are triangular at the base, extended into a long, wavy, apiculate tail; the petals are narrower, both pale yellow in color, and prettily marked with purple. The labellum has the side-lobes erect, hood-like, the front being elongated, wavy, and apiculate, white in color, with a beautiful veining of clear purple. This very fine addition to our gardens was awarded a first-class certificate.



DENDROBIUM SPECTABILE.

TOMATO PRODUCTS.

THE tomato is a wonderful plant; its fruit can be turned to five different accounts, viz.:

(a.) The selected and graded ripe fruit for local or distant markets.

(b.) The Italian "conserva di pomidoro."

(c.) Tomato chutney.

(d.) Tomato sauce.

(e.) Green tomato jam, at the end of the fruiting season.

Let us go through these products systematically:

(a.) The fruit should be smooth, and of a moderately large size. It can be cooked in half a dozen ways. In the raw state it is capital as a salad, treated as follows: Take ripe tomatos, peel them, cut them in halves transversely, remove the seeds should you object to them, and place them in a dish with oil and vinegar, pepper and salt, and sprinkle over the whole a clove of finely chopped garlic, and some finely chopped parsley.

(b.) The Italians, especially in the south, grow the tomato extensively in the summer; all the surplus is made into "conserva di pomidoro," i. e., conserve of tomatos for winter use. This is made as follows: The ripe tomatos are cut in two and boiled in their own juice, that is, without water. They are then pressed through a hair sieve, to get rid of the seeds and skins. The watery part of the purée should not be thrown away, as it contains the salts of the fruit. Then the whole is put into flat dishes and exposed to the sun to dry, after mixing it with a certain quantity of salt. Some sugar may also be added. While in the sun it is every day turned and manipulated with a wooden spoon. It should be dried to a stiff consistence. it can then be preserved in small jam pots, hermetically covered, for winter use. You can see this conserva di pomidoro in the Italian shops in winter; it is used for sauces, for soups and gravies, for macaroni, etc. The difficulty in this country is to keep it from becoming moldy. A chemical friend of mine informs me that the addition of a small quantity of formaline would prevent moldiness, without changing the flavor. Another difficulty in this country may be with respect to the sun. But if made on a large scale for general consumption, the conserve may be sufficiently dried by blowing heated air over it by machinery.

(c.) Tomato Chutney.—This is a very fine compound, and made as follows: 10 lbs. tomatos, 6 lbs. brown sugar, 2½ bottles of vienegar, 1 lb. ginger (ground), 1 lb. garlic (ground), 1 lb. salt, ½ a small bottle of red pepper. Cut the ripe tomatos in halves transversely. Then add the vinegar, sugar, and other ingredients, and boil (without water) in an enameled pot until the whole can be rubbed through a hair sieve. When cool, put up in air-tight, wide-mouthed bottles. If well made, this fine chutney will keep for years, and make a capital relish for curries, cold meat, fish, etc., and also for flavoring sauces.

(d.) Tomato Sauce.—This is made much in the same way as the chutney, only it is made thinner by boiling the tomatos in half a pint of water, and with less sugar. It can then be poured out of a narrow necked bottle. With a little ingenuity and a few experiments, a very nice ready-made sauce can be made out of tomatos, and various kinds of tomato sauce can be manufactured. The color can be varied by using either yellow or white tomatos.

(e.) At the end of the season, when a number of green tomatos remain on the plants, they will make an excellent jam; but this has already been written about.

All this is intended to show that there is money in tomatos, if they are worked up into an industry, and are not merely grown and sold as a market vegetable, just as barley is worked up into ale and stout, apples into cider, and bush fruit into jams, etc.

Finally, it is erroneous to suppose that tomatos will not color unless the plants are largely stripped of their foliage; this seems an unnatural proceeding. What other plant is similarly treated? Are the leaves then of no use to a plant? I had some tomato plants against the back wall of a vinery. Before the fruit was ripe the roof got covered with the vine foliage, and the tomato plants were almost in semi-darkness, yet their fruit colored beautifully. But perhaps for flavor the open air cultivation is the best.

Nor is it necessary for an abundant crop in the open to grow them on a single stem. I had several rows of the plants; I drove a stake at each end of the row, and tied long bamboo canes to them horizontally, and trained the plants against them fan-fashion, without stripping them of side shoots or leaves; they bore abundantly.

The established plants can be planted out in the middle of April, if each plant is protected at night by what may be called a bell box, made of thin boards, with a sloping top, and fitted with a pane of glass, clipped with wire; the small grower can make these boxes up himself.—E. Bonavia, M.D., in The Gardeners' Chronicle.

HEAT-STROKE AND SUN-STROKE.

IN an article that occupies considerably more than half of the Archives de Médecine Navale, for January, Dr. Moussoir, a French naval surgeon of the first-class, claims to be the first observer to have established a fundamental distinction between heat-stroke and sun-stroke, and contends further that a correct appreciation of his discovery would result in a large saving of human life. "I bring here," he says in his opening sentence, "the solution of a problem which has never been resolved in a satisfactory manner;" and a little lower down he expresses his conviction that "the originality of the etiological theory, the prophylaxis arising therefrom, and the proposed pharmaceutical treatment justify the publication" of views that would have seen the light three years sooner but that he was compelled by the exigencies of service to spend the greater part of his time in transferring his household goods from one station to another, including Tonkin and Bac-Ninh. Heat-stroke, according to Dr. Moussoir, is a pathological condition produced by the action on the whole surface of the body during a sufficiently prolonged period of temperature exceeding 104° F., whereas sun-stroke is a pathological condition produced by the action on the cranium during a period, which need not necessarily be long, of sufficiently intense solar radiation. The high temperature which gives rise to heat-stroke may be either moist or dry and may emanate from any source. Moist heat, as in a stoke-hole on board ship, brings on heat-stroke by preventing the evaporation of perspiration, while a dry heat, by shriveling up the skin into a parchment-like substance, prevents the exudation of perspiration, and most probably also produces an analogous condition in the pulmonary alveolar tissue. Heat-stroke causes its ill effects through the superheated blood, which reacts on the nerve centers. It comes on gradually, but may simulate suddenness when the will-power by which the subject was sustained is abruptly withdrawn. Stokers are able to endure a damp hot atmosphere in narrow, ill-ventilated spaces because they work naked or nearly so, whereas soldiers on duty in the open air succumb to heat-stroke because the caloric increases beneath their thick clothing, which also hinders the evaporation of sweat. To prove this three thermometers should be placed—the first in the shade, the second in the sun, and the third likewise in the sun but wrapped in a piece of cloth. An experiment frequently repeated by Dr. Moussoir gave results as follows: first thermometer, 82·4°; second, 110·3°; and third, 127·4°. Sun-stroke, or insolation, is not induced by high temperature but by the intense radiation which the sun alone, owing to its enormous volume (1,200,000 times that of the earth), can supply, the chemical rays, the vibrations of which are more rapid and therefore more penetrating than those of their calorific and luminous congeners, being the exciting cause. Fonssagrives and Corre imagined that the sun-stroke of low temperature during clear weather was due to the action of light on the retina, but this must be an error because, owing to the incautious exposure which is then likely to take place, the affection is very frequently met with while the sky is overcast. The chemical rays emitted by the sun can pierce through white clouds freely, but are almost entirely arrested by black substances, and partially so by red. These facts explain the immunity from sun-stroke of negroes and people with swarthy complexions, and the diminished liability to it of the ruddy. To produce sun-stroke the rays must impinge upon some part of the brain-case, the effect being transmitted thence to the as yet unlocated heat center by reflex

action. The process precisely resembles what goes on when a perspiring scalp is exposed to a draught and sneezing coryza and other reflex phenomena quickly ensue. Covering the head preserves from sun-stroke, but just as is the case with thick clothing a helmet can only assist in the development of heat-stroke. The mean of a series of observations with suspended thermometers showed that the temperature inside a regulation helmet was 10° C. higher than in the shade of a veranda. In heat-stroke the disease begins by heating the blood, but in sun-stroke this condition of the circulating fluid is secondary; the fact, however, that in both affections the blood becomes superheated serves to explain the resemblance of the symptoms. Sun-stroke or insolation can only occur within the tropics, because in that region alone the sun's chemical rays are sufficiently intense to produce the necessary reaction. In support of this statement, Dr. Moussoir appends a number of ingenious diagrams dealing with the refraction of solar rays, but these aids to comprehension require to be seen, while the accompanying lucid letterpress should be read in extenso. So far Dr. Moussoir may, perhaps, be held to have supplied a prima facie case in support of his somewhat ambitious exordium, but with regard to treatment his promises can scarcely be looked upon as fulfilled. Excitation and antipyrin are insisted upon, together with ice, cold affusion, and the rest of the stock remedies as usually recommended. Quinine, however, is discarded utterly, the writer having no belief in its antithermic properties, seeing that in small-pox, scarlet fever, etc., its exhibition fails to reduce the temperature. In paludal fevers the alkaloid acts as a parasiticide, and in sun-stroke there are happily no microbes. Incidentally painting with guaiacol is mentioned, but the effects are said to be prohibitively uncertain. Under its influence hyperthermia is apt to degenerate into hypothermia with cardiac collapse. Among the predisposing causes of heat apoplexy, Dr. Moussoir mentions the horizontal position, contending that the heat rays, both direct and refracted from the ground, have thus a much larger surface to act on. This would seem to supply an argument against the Indian practice of taking a siesta during the heat of the day.—The Lancet.

STRATIFICATION IN VACUUM TUBES.

M. H. PELLAT has recently brought before the Académie des Science an account of a series of researches which he has undertaken in order to explain the nature of the stratification which occurs in vacuum tubes upon the passage of the electric discharge. It has been generally supposed that this stratification is due to the interference of direct and reflected waves, causing a series of nodes and loops whose presence seems to be manifest in the bright and dark bands which appear in the tube. The experiments made by M. Pellat seem to show that this hypothesis can no longer be held. The tube was placed between the poles of a powerful electro-magnet, its direction being perpendicular to the direction of the magnetic field, and the following phenomena were obtained. A tube, 85 centimeters long, and 1 centimeter internal diameter, containing air and provided with interior electrodes, was connected with a mercury pump, by which a variable degree of exhaustion could be obtained. For pressures between 10 and $\frac{1}{10}$ millimeter of mercury there was observed but one stream of rays deviated by the magnetic field, this is the most intense part of the field being reduced to a brilliant thread-like stream, having a diameter about 1 millimeter, and touching the inside of the tube. Under these conditions it is clear that there could be neither reflected waves, which would have been deflected in the contrary sense by the magnet, nor electrical oscillations. In spite of this fact, very fine stratifications were produced in the tube, especially at pressures varying between 1 and $\frac{1}{10}$ millimeter of mercury, these being much better defined in the portion acted upon by the magnetic field. A second experiment was made with a closed tube of about the same dimensions as the former, but closed at both ends and containing rarefied vapor of alcohol. It had no interior electrodes, but each end was provided with a cap of tinfoil, to which was connected one pole of the induction coil. This system constituted, in fact, two condensers in series; at each interruption of the vibrator, and at very short intervals, a current passes in the tube in one direction and in the other, representing the charge and discharge of the condensers. The two currents cause an illumination of the tube. Under the action of the magnetic field the two currents were deflected in contrary directions and thus separated over a great part of the length of the tube. In the most intense part of the magnetic field the currents were reduced to two thread-like streams, there being deflected against opposite sides of the tube. By observing these streams in a revolving mirror, they are seen to have a greater or less distance apart, according to the direction of rotation of the mirror, this being due to the fact that they are not simultaneous. In this experiment very fine stratifications were observed in all parts of the streams thus separated, even in the thread-like portions in the intense field. In neither of these experiments is it possible to explain the presence of the stratification upon the hypothesis of a direct and a reflected wave.

Consul Hughes, of Coburg, under date of February 6, 1900, writes:

Owing to the strikes in the coal mines in Bohemia and Saxony, all the large and small manufactories of china, glass, toys, and dolls have had to cut down their productions to about one-third. Coming, as this does, at a time when all the different concerns are crowded with orders for the United States and England, it makes the outlook for prompt deliveries very poor.

Prices of all local goods are bound to go up. The various branches of the trades are having meetings to increase the cost for export, and American buyers will find products higher in price than they were last year, and the delivery time much longer.

Imitation Amber.—A firm at Gablonz, Bohemia, has patented the following composition of imitation amber: Pine resin, 1; laca in tabulis, 2; white colophony; which are carefully melted together.—Journal der Goldschmiede Kunst.

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